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# Taking "Fun and Games" Seriously: Proposing the Hedonic-Motivation System Adoption Model (HMSAM)

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## Abstract

*Hedonic-motivation systems (HMS)—systems used primarily to fulfill users' intrinsic motivations—are the elephant in the room for IS research. Growth in HMS sales has outperformed utilitarian-motivation systems (UMS) sales for more than a decade, generating billions in revenue annually; yet IS research focuses mostly on UMS. In this study, we explain the role of intrinsic motivations in systems use and propose the hedonic-motivation system adoption model (HMSAM) to improve the understanding of HMS adoption. Instead of a minor, general TAM extension, HMSAM is an HMS-specific system acceptance model based on an alternative theoretical perspective, which is in turn grounded in flow-based cognitive absorption (CA). The HMSAM extends van der Heijden's (2004) model of hedonic system adoption by including CA as a key mediator of perceived ease of use (PEOU) and of behavioral intentions to use (BIU) hedonic-motivation systems. Results from experiments involving 665 participants confirm that, in a hedonic context, CA is a more powerful and appropriate predictor of BIU than PEOU or joy, and that the effect of PEOU on BIU is fully mediated by CA sub-constructs. This study lays a foundation, provides guidance, and opens up avenues for future HMS, UMS, and mixed-motivation system research*

***Keywords**: Hedonic-Motivation System Adoption Model (HMSAM), Technology Acceptance Model, Cognitive Absorption, Immersion, Hedonic-Motivation Systems, Utilitarian-Motivation Systems, Mixed-Motivation Systems, Gaming, Intrinsic Motivation, Extrinsic Motivation.*

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# 1. Introduction

The most explosive growth in the computing industry no longer belongs to the business sector but to home and personal computing (Brown & Venkatesh, 2005; Hsu & Lu, 2007). Since 1996, growth in U.S. video game software sales has been more than triple the growth of utilitarian software sales (ESA, 2007). Facebook boasted more than one billion active users as of October 2012, with more than 600 million users accessing the social network via a mobile device (Facebook, 2012). With the explosion of mobile computing, social computing, and gaming, an economic and social revolution in technology usage is under way. The adoption and use of hedonic-motivation systems (HMS)—systems used primarily for pleasure rather than for productivity—is becoming increasingly important to the global economy. However, information systems (IS) researchers have traditionally ignored research on HMS, which has made it into the elephant in the room for IS research. Given the serious global, economic, and organizational consequences of HMS, it is time for IS researchers to consider HMS as seriously as they do organizational systems.

HMS use is fundamentally different from utilitarian-motivation systems (UMS) use. HMS—such as video games, social networking sites, and virtual worlds—can create a level of deep immersion and devotion rarely seen with UMS (Jegers, 2007; Sherry, 2004). Additionally, users who devote time to HMS do so for intrinsic rewards and generally have little concern for any potential external reward they might receive (Sweetser & Wyeth, 2005); rather, they are concerned mostly with the process or experience of use itself. Conversely, to motivate system use and acceptance, UMS must offer external benefits to users (Venkatesh, Morris, Davis, & Davis, 2003), and UMS users are more concerned with specific outcomes of use than the process involved in use.

Because of these important differences in motivations for using systems, recent acceptance research has begun to identify how acceptance and use of HMS differ from those of UMS (e.g., Brown & Venkatesh, 2005; Parboteeah, Valacich, & Wells, 2009; van der Heijden, 2004). This research has explained the motivation for giving attention to and accepting systems in terms of intrinsic and extrinsic motivation. Intrinsic motivations can affect human behavior more powerfully than extrinsic motivations (Csikszentmihalyi, 1990; Thomas & Velthouse, 1990). Accordingly, joy[1] (i.e., perceived enjoyment), a type of intrinsic motivation, was added to the technology acceptance model (TAM) (Venkatesh, 2000), and intrinsic motivation has continued to receive attention in IS acceptance research (e.g., Qiu & Benbasat, 2009; Saadé, Nebebe & Mak, 2009; van der Heijden, 2004; Venkatesh, 2000).

To better address the various intrinsic motivations associated with system use and acceptance, Agarwal and Karahanna (2000) proposed the construct cognitive absorption (CA)—a deep state of involvement with software systems stemming from intrinsic motivation. CA, however, has been used primarily to explain the use and acceptance of utilitarian- and mixed-motivation systems (e.g., Agarwal & Karahanna, 2000; Jiang & Benbasat, 2007; Shang, Chen, & Shen, 2005) and has not yet been applied to forms of HMS use in which CA might actually be most appropriate and applicable. For example, Agarwal and Karahanna (2000) studied students' interactions and engagement with the World Wide Web in general. However, the Web is designed for mixed motivations, not primarily hedonic motivations. In an attempt to focus on HMS use, van der Heijden (2004) proposed a model of hedonic IS acceptance. Yet van der Heijden's study employed the construct joy as the surrogate for intrinsic motivation, rather than taking advantage of the more comprehensive CA construct.

To address these opportunities, we build and test a new model called the hedonic-motivation system acceptance model (HMSAM). Instead of a minor, general TAM extension, HMSAM is an HMS-specific system acceptance model grounded in an alternative theoretical perspective. The theory we develop focuses directly on the underlying motivations driving HMS acceptance in a process-oriented context; in this context, intrinsic motivation is more prominent than the outcome-oriented extrinsic motivation

[1] Joy is the extent to which the activity of using the computer is perceived to bring about pleasure and joy for their own sake, apart from any anticipated performance consequences (Hong & Tam, 2006; Lee, Cheung, & Chen, 2005; Wu & Liu, 2007).

generally emphasized in traditional TAM studies. It is by illuminating alternative theoretical perspectives and providing evidence for important theoretical boundaries that system acceptance studies continue to make meaningful contributions (Venkatesh & Bala, 2008; Venkatesh, Davis, & Morris, 2007). The HMSAM builds on the acceptance model proposed by van der Heijden (2004), with two major extensions designed to capture the key role of intrinsic motivation in HMS use. First, we use CA, a comprehensive representation of various intrinsic motivation aspects. Second, we explain and predict the CA sub-constructs individually rather than as a single second-order construct. We explain that separating the CA sub-constructs is actually more consistent with flow theory, on which CA is based. We begin by presenting some necessary background on the roles of and differences between intrinsic motivation and extrinsic motivation in the context of system use. We then outline our extensions of van der Heijden's model, develop and test our theory, and conclude with the implications of our findings.

## 2. The Dominant Role of Intrinsic Motivation in HMS Use

Because our focus on HMS departs from that of traditional IS adoption literature, this section clarifies how extrinsic motivations differ from intrinsic motivations to demonstrate the contribution that the HMSAM makes to the IS discipline. Cognitive evaluation theory (CET, or self-perception theory), which seeks to explain human motivation and subsequent behavior, establishes the conceptual differences between intrinsic motivation and extrinsic motivation (Deci & Ryan, 1985; Hirschfeld & Lawson, 2008; Rummel & Feinberg, 1990; Ryan & Deci, 2000). The basic CET assumption is that motivations can induce an individual to engage in certain interactions. CET explains that intrinsic motivation can be defined in terms of what people will do without external inducement (Malone, 1981; Malone & Lepper, 1987), whereas extrinsic motivation can be defined in terms of what people will do because of external inducement (DeShon & Gillespie, 2005; Dweck & Leggett, 1988; VandeWalle, Cron, & Slocum, 2001).

Although the adoption literature on intrinsic motivation has typically centered on joy alone, intrinsic motivation often involves many other factors (Reiss, 2004), such as needs for competence (i.e., self-efficacy) and autonomy (i.e., personal control). These needs are the fundamental basis for intrinsic motivation (Deci & Ryan, 1985)[2]. Thus, fulfilling intrinsic motivation increases one's sense of competence and autonomy (Deci & Ryan, 1985), which makes for a more pleasurable experience that the user desires to repeat or sustain, which is critical to system acceptance. Tangible rewards, deadlines, directives, and threats (common to extrinsic motivation) are examples of factors that undermine perceptions of self-efficacy and control (and of related joy and satisfaction) (Deci, 1975; Ryan & Deci, 2000).

Comparisons between intrinsic and extrinsic motivation have generally shown that, regardless of perceived initial competence or autonomy, intrinsic motivation is more useful for enhancing performance, persistence, creativity (Deci & Ryan, 1991; Sheldon, Ryan, Rawsthorne, & Ilardi, 1997), and even self-esteem (Deci & Ryan, 1995). Likewise, intrinsic motivation has been shown to be consistently more predictive of human behavior than extrinsic motivation (Deci, 1975; Deci & Ryan, 1985). According to CET, fulfilling extrinsic motivation is rarely sufficient to keep individuals satisfied and engaged in the long term because using extrinsic motivation materially lowers individuals' sense of self-efficacy and control and can ultimately be demoralizing. In fact, Bandura (2001) argues that the most fundamental aspect of human existence is increasing personal control over one's environment. The preeminence of this factor explains why external "rewards", such as payment and grades, can eventually make someone feel manipulated, micromanaged, and unfulfilled (Butler & Nisan, 1986; Condry, 1977; Deci, 1976; McGraw, 1978). These theoretical insights apply directly to systems use.

In HMS use, extrinsic motivation is either irrelevant or subordinate to intrinsic motivation because participants are not paid and they do not participate for employment, efficiency gains, or any other

[2] Like Deci and Ryan (1985), Gill (1996) theorizes that intrinsic motivation is more than enjoyment, and conceptualizes intrinsic motivation in three categories: control, arousal, and achievement. Interestingly, although Deci and Ryan's theory is based on motivational models, Gill's work is based on expectancy theory; thus, two different views on intention-behavior research have found similar intrinsic motivation concepts.

extrinsic benefit[3]. Thus, the practical relevance of perceived usefulness (PU) in its traditional sense is diminished in the HMS context because PU is highly secondary or inconsequential to HMS use. For example, such systems do not help users become more informed, perform tasks better, or accomplish assignments more easily. This lack of relevance has been demonstrated by the results of HMS and MMS research. For example, in research on hedonic uses of mobile computing, PU was shown to have weakened predictive power (Wakefield & Whitten, 2006). Other HMS research in which PU was shown to be irrelevant includes studies on multiplayer online role-playing games (Putzke, Fischbach, Schoder, & Gloor, 2010), music sites (Chu & Lu, 2007), console gaming (Hsu & Lu, 2004), video sites (Kim, Na, & Ryu, 2007), online pornography (Paul & Shim, 2008), and cybersex (Albright, 2008). This predominance of intrinsic over extrinsic motivation was found even in user interactions with UMS (Venkatesh, 1999). Moreover, even though the relationship between PU and BIU was statistical significant in van der Heijden's (2004) MMS context, the relationship was not practically relevant because the path strength was below standard thresholds ($\beta$ was only at 0.15)[4]. For the same reasons that we outline in this section, a recent HMS study showed that PU was not significant in the model (Hsu & Lu, 2004), and PU was subsequently dropped from a related follow-up study (Hsu & Lu, 2007). In consideration of these arguments and the evidence for the predominance of intrinsic over extrinsic motivation in the context of HMS, we retain PU in our model but contextualize it as usefulness expected for an HMS (e.g., useful for having fun, relaxing), not for a UMS (e.g., useful for productivity, performance), as the Section 3 explains.

# 3. Extending van Der Heijden's Model of HMS Use

We employ as a baseline the van der Heijden (2004) hedonic-system acceptance model (a variation of TAM) that predicts the determinants of BIU for HMS, which Figure 1 summarizes. Notwithstanding the baseline model's intended focus on HMS, the system used in van der Heijden's (2004) study (a cinema website) contained extrinsic motivation elements—for example, to make more informed decisions about which movies to see, stay informed about new movie developments, and make scheduling decisions. Accordingly, PU was used to measure extrinsic motivations, using items such as "by using the system, I am better informed" and "I can better decide which movie I want to go see". Thus, extrinsic motivations were admittedly present and influencing user attitudes toward system use. However, the website also involved clear hedonic aspects representing intrinsic motivations; thus, PEOU and joy were posited as stronger predictors than PU. Importantly, we design and test the HMSAM for forms of IS use motivated mainly by intrinsic factors, with minimal extrinsic influences. Because HMS use does not include efficiency or productivity goals, the perceived usefulness of hedonic systems relates more to "the usefulness of pursuing pleasure" (Gu, Fan, Suh, & Lee, 2010) than to utilitarian usefulness. We now propose two major extensions of the van der Heijden (2004) model designed to capture the key role of intrinsic motivation in explaining BIU for HMS.

## 3.1. Extension 1: Replacing Joy with Cognitive Absorption (CA)

Joy, or perceived enjoyment (PE), is the extent to which using a system is perceived to bring pleasure and fulfillment for their own sake, apart from any anticipated performance consequences (Hong & Tam, 2006; Lee et al., 2005). However, relying solely on joy to represent intrinsic motivation exaggerates the role of joy while ignoring other aspects of intrinsic motivation (e.g., Choi & Kim, 2004; Hsu, Chiu, & Ju, 2004; Hsu & Lu, 2004; Hsu & Lu, 2007; Jegers, 2007; Reiss, 2004; Sweetser & Wyeth, 2005). Table 1 summarizes the literature that has addressed other kinds of IM—particularly for HMS.

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[3] Clearly, extrinsic and intrinsic motivations are not always dichotomous (both can exist in systems use, even in systems designed to be exclusively hedonic or utilitarian), and both likely exist along a spectrum that ultimately depends on a particular user's perspective. Hence, being primarily intrinsically motivated does not mean that a person will not seek external rewards. It means only that external rewards alone are not sufficiently compelling to motivate a person to perform a task. Each motivation lies on a spectrum between a completely internal and a completely external locus of control (Ryan & Deci, 2000). An intrinsically motivated student, for example, may want to get a good grade on an assignment, but if the assignment does not interest that student, the possibility of a good grade alone may not be enough to motivate him or her to put full effort into the assignment (Malone, 1981; Malone & Lepper, 1987). However, the focus of the current study is primarily on HMS in which extrinsic motivations do not play a major role.

[4] Chin (1998) indicated that to demonstrate the meaningful predictive power of an SEM model, one needs to show high $R^2$s and substantial and significant structural paths. To be "substantial" and to demonstrate the meaningful predictive power of the model, standardized paths need to be close to .20 (and ideally .30 or higher).

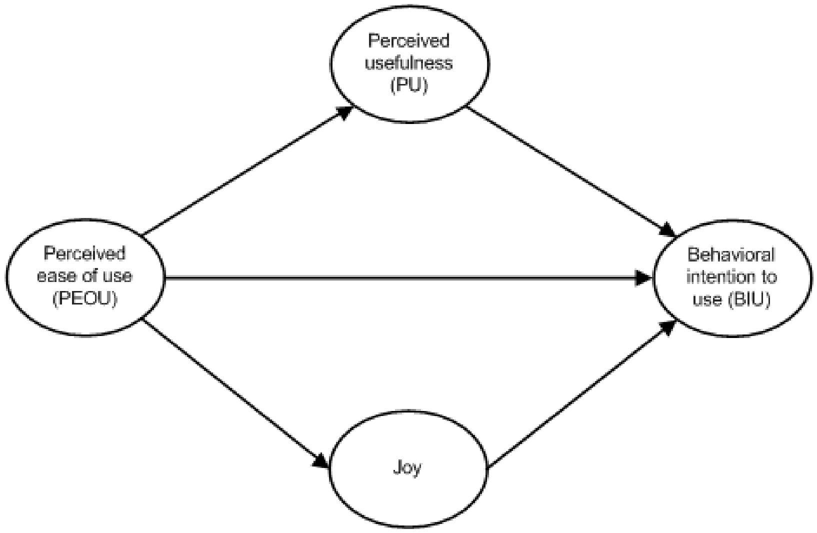



**Figure 1. Van der Heijden's Model as the Baseline for the HMSAM**

**Table 1. Various Intrinsic Motivations for Using Systems**

| Example IM | Citations of use in systems literature |
|---|---|
| Desire to play and have fun | (Chu & Lu, 2007; Hsu & Lu, 2004; Kim et al., 2007; Li, Chau, & Lou, 2005; Lin, Tai, & Fang, 2008; Premkumar, Ramamurthy, & Liu, 2008; Stafford & Stafford, 2002; Wasko & Faraj, 2000; Wu, Li, & Rao, 2008; Wu & Liu, 2007) |
| Escape pressures | (Joines, Scherer, & Scheufele, 2003; Thompson & Prottas, 2006) |
| Engage in challenges | (Foltz, 2004; Vorderer, Hartmann, & Klimmt, 2003) |
| Become immersed in recreation | (Davis, Murphy, Owens, Khazanchi, & Zigurs, 2009; Li et al., 2005; Premkumar et al., 2008) |
| Satisfy curiosity | (Agarwal & Karahanna, 2000; Barber, 2001; Katz & Aspden, 1997; Kim et al., 2007; McClure, Scambray, & Kurtz, 2009; Van Beveren, 2000) |
| Discover novel things | (Barnes, 2007; Yee, 2006) |
| Desire to express oneself | (Barnes, 2007; Becker, 2000; Nardi, Schiano, & Gumbrecht, 2004; Oksman & Turtiainen, 2004) |
| Obtain knowledge | (Becker, 2000; Embar-Seddon, 2002; Katz & Aspden, 1997; Ryan et al., 2006; Stafford & Stafford, 2002) |
| Experience autonomy/freedom | (Alm, 2006; Hertel, Niedner, & Herrmann, 2003; Ryan, Rigby, & Przybylski, 2006) |
| Develop peer companionship | (Davis et al., 2009; Katz & Aspden, 1997; Oksman & Turtiainen, 2004; Ran & Lo, 2006; Ryan et al., 2006; Yee, 2006) |
| Receive approval | (Butler, Sproull, Kiesler, & Kraut, 2002; Foltz, 2004; McClure et al., 2009; Ye & Kishida, 2003) |

This review illustrates the limitations of using only the construct of joy to represent IM. Accordingly, we assert that the lesser-used construct CA is a dramatic improvement over using joy alone. CA is conceptualized as a second-order construct comprising five first-order constructs (Agarwal & Karahanna, 2000, p. 674):

1. Control: "the user's perception of being in charge of the interaction"
2. Curiosity: "the extent the experience arouses an individual's sensory and cognitive curiosity"
3. Heightened enjoyment (which we term joy for short): "the pleasurable aspects of the interaction described as being fun and enjoyable rather than boring"
4. Focused immersion: "the experience of total engagement where other attentional demands are, in essence, ignored"
5. Temporal dissociation: "the inability to register the passage of time while engaged in an interaction"

Recent research has validated the increased explanatory power of replacing joy with CA, but a key limitation is that none of these studies has been conducted with HMS. Researchers who have employed CA as a substitute for intrinsic motivation in IS research have done so only with UMS and MMS. For example, Agarwal and Karahanna (2000) conducted their study in an MMS context (the Web in general), as did Saadé and Bahli (2005) (an online learning website) and Wakefield and Whitten (2006) (mobile devices). Figure 2 depicts our substitution of CA for joy in van der Heijden's (2004) model.

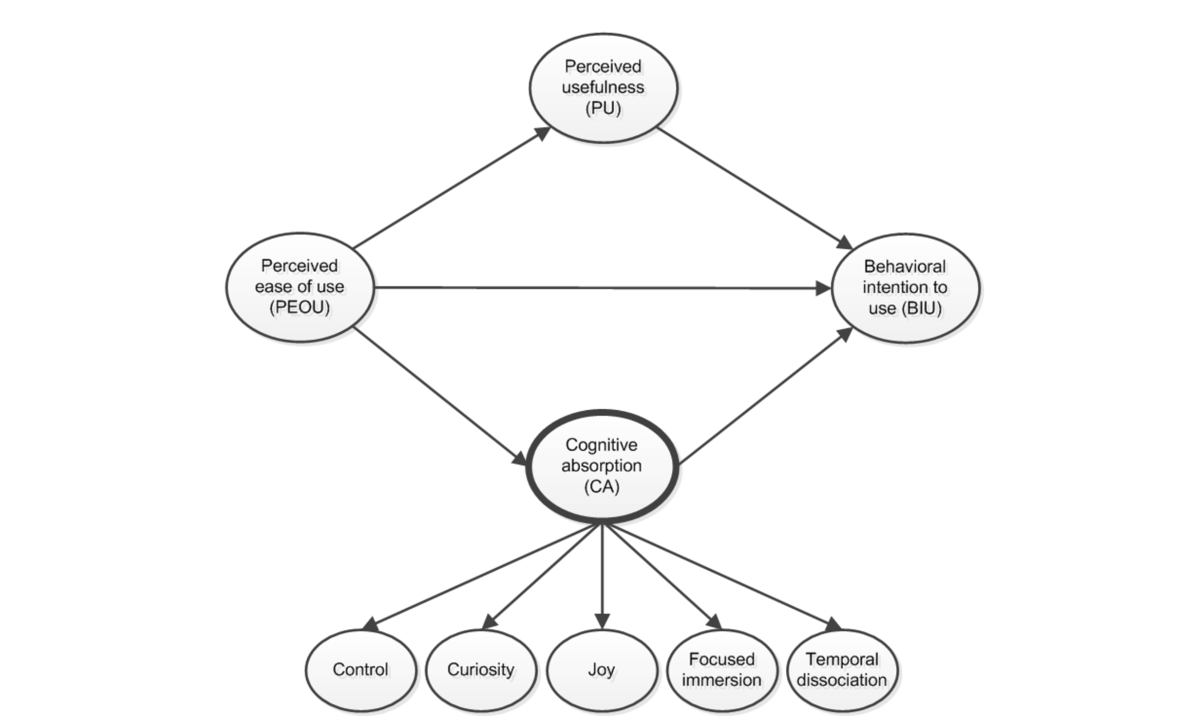



**Figure 2. Expanding Intrinsic Motivation from Joy to CA**

## 3.2. Extension 2: Using the Cognitive Absorption Sub-Constructs

Our next improvement is to expand the HMSAM by using each CA sub-construct individually, instead of collapsing them into a single second-order construct. We argue that this expanded representation is better aligned with the originally intended use of the CA sub-constructs, because flow theory—CA's theoretical basis—does not combined them into a single second-order construct. Although lumping these sub-constructs into one simultaneously occurring second-order construct has the virtue of simplicity, we provide evidence from the HMS literature that these sub-constructs have different causes (and thus predictors) and likely do not occur simultaneously[5].

Flow theory serves as the primary evidence for asynchronous effects. CA was built on the conceptual foundation of flow theory; yet flow theory,[6] and its substantial base of related empirical results, represents these sub-constructs separately because they have different causal mechanisms and do not occur simultaneously. Noteworthy aspects of flow in HMS use include a sense of control, intense concentration, loss of self-consciousness, time distortion, and merging of action and awareness (Agarwal & Karahanna, 2000; Nakamura & Csikszentmihalyi, 2002). Important to our claim, flow theory conceptualizes flow as something that happens in stages rather than all at once, and this is supported by substantial empirical evidence (Brown & Cairns, 2004; Chen, 2007; Ermi & Mäyrä, 2005; Jennett et al., 2008; Weibel, Wissmath, Habegger, Steiner, & Groner, 2008; Wild, Kuiken, & Schopflocher, 1995; Witmer & Singer, 1998). Despite this evidence, the extant use of CA in the IS literature has lumped CA's related constructs together—a practice that we assert is too much of a simplification for HMS use.

## 4. Theory Development

We now implement the above extensions to further propose the HMSAM. Figure 3 represents the proposed HMSAM. We do not explicitly replicate hypotheses for the baseline model shown in Figure 1, but refer the interested reader to van der Heijden's (2004) work for these paths.

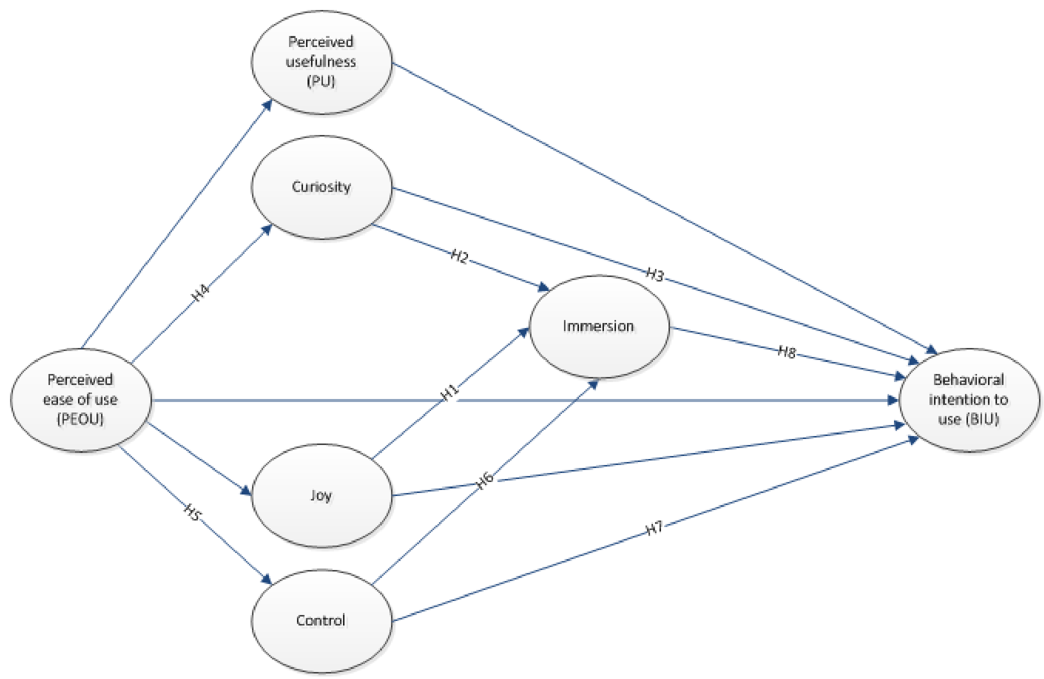



**Figure 3. Proposed Hedonic-Motivation System Adoption Model (HMSAM)**

[5] Wakefield and Whitten (2006) also break up the CA construct to capture the unique variance of joy when predicting BIU in a mobile computing acceptance study. They support this move by arguing that joy is an affective response, whereas the other CA sub-constructs are cognitive functions.

[6] Flow theory has been used since 1974 to explain attention and involvement in contexts involving high IM (Csikszentmihalyi, 1990; Tellegen & Atkinson, 1974). Flow theory was not developed with systems in mind, although it has been extensively applied to systems, including HMS (e.g., Choi & Kim, 2004; Hsu & Lu, 2004; Sweetser & Wyeth, 2005). Flow is generally defined as an absorbing "experience so gratifying that people are willing to do it for its own sake, with little concern for [any external reward]" (Csikszentmihalyi, 1990, p. 71).

We argue that joy predicts immersion in an HMS context, whereas, in non-HMS contexts, joy would not necessarily be required to create immersion. As the HMSAM is contextualized for hedonic systems, this emphasis of joy and immersion is just one more theoretical contribution. For example, immersion could legitimately occur in an extrinsic motivation interaction if a worker becomes immersed in a routine flow of systematic tasks. However, in an intrinsic motivation interaction, such as gaming, joy should play a greater role in bringing about immersion (Csikszentmihalyi, 1975; Nakamura & Csikszentmihalyi, 2009; Wild et al., 1995). Flow theory posits that, if a person enjoys his or her interactions and has intrinsic motivation to perform some task, immersion or flow is a logical causal outcome (Guo & Poole, 2009; Webster, Trevino, & Ryan, 1993). Again, as asserted by Sweetser and Wyeth (2005), “if players do not enjoy the game, they will not play the game” (p. 1); and if they do not play it, they cannot achieve immersion. Additionally, the more one enjoys one’s interaction, the more willing one will be to devote attention to the stimuli offered by that interaction (Berlyne, 1954; Cupchik, Vartanian, Crawley, & Mikulis, 2009; Nadkarni & Gupta, 2007), which enables a greater portion of one’s cognitive resources to be occupied by the interaction. This devotion of a majority of one’s attention to the interaction at hand leads directly to immersion (Berlyne, 1954), which cognitive science research on virtual reality has recently demonstrated (Parsons, Iyer, Cosand, Courtney, & Rizzo, 2009). For example, if an individual’s joy in a video game increases during an interaction, he or she will likely become more immersed at that time than during periods of less enjoyable gameplay. Thus, we hypothesize:

***H1:*** *An increase in joy will increase immersion.*

We argue that curiosity will increase immersion. Curiosity is an increase in interest or “a heightened arousal of sensory and cognitive” inquisitiveness (Agarwal & Karahanna, 2000p. 668) representing heightened attention or “increased perception of stimuli” (Agarwal & Karahanna, 2000; Berlyne, 1954p. 180; Lim, Lim, & Heinrichs, 2005; Sweetser & Wyeth, 2005; Webster & Ho, 1997). Attention research shows that novelty7 increases curiosity as well as attention; conversely, boredom undermines attention (Posner & Boies, 1971). People give attention to stimuli that are personally interesting—that is, stimuli that evoke curiosity (Posner & Boies, 1971). The more curious people are about a particular set of stimuli, the more attention they will be willing to devote to pursuing that curiosity (Posner & Boies, 1971). Because immersion is the consequence of multiple stages of increased attention over time (see for e.g., Brown & Cairns, 2004; Chen, 2007; Ermi & Mäyrä, 2005; Jennett et al., 2008; Weibel et al., 2008; Wild et al., 1995; Witmer & Singer, 1998), increases in curiosity in an HMS context should lead to an increase in immersion (Berlyne, 1954; Sweetser & Wyeth, 2005). Thus, we hypothesize:

***H2:*** *An increase in curiosity will increase immersion.*

Curiosity is a key motivational state that increases exploratory behavior and leads to additional engagement (Kashdan, Rose, and Fincham, 2004; Kashdan & Silvia, 2009), and thus does not necessarily require joy to exist (Berlyne, 1954). Important to an HMS context, curiosity amplifies excitement about the human-system interaction (Agarwal & Karahanna, 2000; Lim et al., 2005; Sweetser & Wyeth, 2005; Webster & Ho, 1997)—leading a user to desire to repeat that excitement through further engagement (Kashdan et al., 2004; Kashdan & Silvia, 2009), which in turn naturally results in increased BIU. Additionally, humans have a common desire to satisfy their curiosity (Berlyne, 1954; Reiss, 2004), and curiosity can best be satisfied when acted on. Using a system is a way to act on one’s curiosity about the system. Consequently, an increase in curiosity about a system would likely result in an increase in BIU to satisfy one’s curiosity (Qin, Rau, & Salvendy, 2009; Pace, 2004). Thus, we hypothesize:

***H3:*** *An increase in curiosity will increase BIU.*

We propose that an increase in PEOU will increase curiosity. As a foundation, PEOU is a base-level expectation for HMS (Sweetser & Wyeth, 2005). For example, if a game is low in PEOU, the player will more likely become frustrated, grow apathetic, and cease to devote attention to the game—

[7] *Novelty* refers to stimuli that are unique and sensory (Egeth, 1967; Johnston & Dark, 1986).

causing a loss of curiosity about the game. However, if a game is easy to use, a player's attention is free to explore and become excited about the "available possibilities" of his or her interaction with the game (Zhang, Li, & Sun, 2006, p. 4). Although little extant research has related PEOU and curiosity, Koo and Choi (2010) found that these two constructs were highly correlated (however, this was not the authors' theoretical proposition; they used curiosity as a moderator). Similarly, Rouibah (2008) found a strong correlation between PEOU and curiosity; however, Rouibah predicted that the direction of causality would be from curiosity to PEOU, rather than from PEOU to curiosity, as we predict. In Rouibah's study, support for this hypothesis was combined with support for another, and this hypothesis was largely neglected. We argue that PEOU will increase curiosity rather than the converse because, if a system is easy to use, then complexity (a potential barrier to interest) does not prevent a user from interacting freely with the system (Sun & Zhang, 2006). Free to use the system, a user will have more opportunities to engage in novel interactions that will increase curiosity about the system (Posner & Boies, 1971); by contrast, if a system is not easy to use, a user might not get beyond the initial barrier of complexity (Sun & Zhang, 2006). Thus, we hypothesize:

***H4:*** *An increase in PEOU will increase curiosity.*

We argue that PEOU is an inherent determinant of perceived control. Control, an interdisciplinary construct, has been richly applied to flow theory (Csikszentmihalyi, 1975; Koufaris, 2002), CA (Agarwal & Karahanna, 2000), self-efficacy (Bandura, 1982), and the theory of planned behavior (Ajzen, 1991). Control is the ability to manage one's interaction, including the ability to interrupt the interaction, to be spontaneous and unpredictable, to adapt the interaction to one's desires, to make choices, and to be generally in charge of an interaction (Agarwal & Karahanna, 2000; Liu & Shrum, 2002; Lowry, Romano, Jenkins, & Guthrie, 2009; Zack, 1993).

We propose that a user is more likely to feel in control of a system interaction when the system is easy to use. When a system is easy to use, a corresponding increase in self-efficacy occurs, which is an important component of control (Taylor & Todd, 1995; Venkatesh & Davis, 1996). Self-efficacy is the perception of one's ability to plan and take action to reach a particular goal (Bandura, 1982; 1997). PEOU consequently increases perceptions of control because the user feels more equipped to accomplish his or her goals. Indeed, Agarwal and Karahanna (2000) found a strong correlation between PEOU and control. Conversely, if a system is difficult to use, a user is unlikely to feel that he or she is in control of the interaction, and he or she is more likely to feel frustrated and anxious (Compeau & Higgins, 1995)—reducing self-efficacy (Agarwal & Karahanna, 2000; Compeau & Higgins, 1995; Liu & Shrum, 2002). Venkatesh (2000) also found a consistent and strong positive relationship between PEOU and control[8]. Thus, we hypothesize:

***H5:*** *An increase in PEOU will increase control.*

We posit that control increases immersion. Flow theory posits that a person should be actively engaged before achieving focused immersion (i.e., a state of flow) (Csikszentmihalyi, 1975; Wild et al., 1995). Hence, control becomes a critical element in achieving this state because active engagement is more likely to occur when a person perceives that he or she has control during an experience (Webster & Ho, 1997). The ability to experience some control when interacting with a system is a key reason people are drawn to interactive computer games over other forms of entertainment (Salen & Zimmerman, 2003).

We argue that this increased demand on attention and control will lead to a deeper level of immersion (Berlyne, 1954). Self-efficacy theory posits that perceived control is a partial means by which a person feels he or she is competent, able, and capable of making decisions (basic human needs). Conversely, if one feels a lack of control, negative affect, physiological strain, and even depression can occur because of the ensuing feelings of lack of agency and competence

[8] Venkatesh (2000) operationalized control as computer self-efficacy. Self-efficacy is an a priori characteristic of the user before the treatment in an experiment. Thus, it was natural for Venkatesh to hypothesize that the causal direction would be from control to PEOU. However, control during an interaction is evaluated either during or after the treatment—not a priori. Accordingly, we hypothesize that the causal direction flows from PEOU to control.

(Bandura, 1992; Brockner et al., 2004; Ghorbani, Krauss, Watson, & LeBreton, 2008; Maddux & Meier, 1995; Zellars, Perrewe, Rossi, Tepper, & Ferris, 2008). Although lack of control in HMS use likely would not result in more dramatic negative results (e.g., depression), it certainly would induce negative affect, which would undermine one's desire and ability to experience immersion in an HMS interaction. An increase in control would tend to enable the desire and ability to become immersed (Guo & Poole, 2009). Thus, we hypothesize:

***H6:*** *An increase in control will increase immersion.*

We posit that an increase in control will increase BIU. People have an inherent desire for autonomy and control (Bandura, 1997; Deci, 1975), which, when fulfilled, creates a positive affective response (Reiss, 2004). Positive affect (conceptualized as attitude toward the behavior) is intrinsically desirable, and thus is sought after (Davis, 1989). In the TAM, positive affect was found to predict BIU in a systems use context (Davis, 1989). Similarly, Djamasbi and Strong (2008) found that positive affect toward a system is a predictor of BIU. Walter and Lopez (2008) found that any threat to control or autonomy resulted in a direct negative effect on BIU. In a study of the intrinsic motivation and extrinsic motivation that affect BIU, Malhotra, Galletta, and Kirsch (2008) found that an increase in perceived control (conceptualized as perceived internal locus of causality) led to an increase in BIU (for users of the BlackboardTM educational system). Given these findings, we extend this relationship to an HMS context. Specifically, if a user encounters greater perceived control when interacting with an HMS, that greater control will be reinforced with a positive affective response, and the user will desire to continue the interaction. In contrast, if the user feels a lack of control, BIU will decrease. Thus, we hypothesize:

***H7:*** *An increase in control will increase BIU.*

We posit that immersion increases BIU. Agarwal and Karahanna (2000) found that focused immersion and temporal dissociation—which, in the HMSAM, comprise the construct of immersion—were strongly correlated with BIU. Immersion is key to enjoying HMS (Jennett et al., 2008; Teng, 2010); and, as noted previously, enjoyment is a desirable affective response sought after by users (Davis, Bagozzi, & Warshaw, 1989; Djamasbi & Strong, 2008). Consequently, we argue that users who experience high levels of immersion when using HMS are more likely to desire to continue interacting with the system. For example, players who seek highly "engulfing and enjoyable" games require a high level of immersion and will seek games that can deliver such an experience (Wakefield & Whitten, 2006 p. 293). Wakefield and Whitten (2006) concluded that when immersion "is high, users indicate significantly greater enjoyment, usefulness, and usage intentions compared to users with low [immersion]" (p. 295). Similarly, Teng (2010) found that, when users' immersive needs were satisfied, the users became loyal the system. Thus, we hypothesize:

***H8:*** *An increase in immersion will increase BIU.*

# 5. Method

We tested the HMSAM using two related studies. Study 1 was a thought experiment that used scenarios and storyboards to represent a range of gaming experiences to test the HMSAM. Study 2 used actual games in a controlled laboratory experiment. The purpose of our experiments and analysis was to assess the psychometric properties and theorized relationships in our model. Additionally, the analysis compared the model fit of our proposed model to van der Heijden's (2004) model to assess whether CA should be modeled as a second-order construct or as four separate and distinct constructs.

## 5.1 Study Design

We designed the preliminary storyboard experiment (Study 1) and the controlled laboratory experiment (Study 2) to provide a range in quality of gaming experiences so that some participants would have enjoyable experiences whereas others would have experiences that were below their expectations. To ensure that these intended experiences differed in the direction we intended, we conducted manipulation checks on two key drivers of the HMSAM: PEOU and joy. Study 1 used 12 written scenarios, with associated graphical storyboards, which were randomly assigned to participants in a thought experiment. This design resembled scripted scenario designs used in other studies (e.g., Lowry, Moody, Galletta, & Vance, 2013; Malhotra, Kim, & Agarwal, 2004; Vance, Lowry, & Eggett, 2013) and those used extensively in practice for HMS design (e.g., Cilella, Berman, & Rheinfrank, 2010; Jhala, Bares, & Young, 2005; Kim, 2005; Pardew, 2004; Robertson & Good, 2005; Schewe & Thalheim, 2008). The combination of the graphical storyboards and written scenarios was designed to create some variation so that our path model test with SEM would be more meaningful. Based on these descriptions, we then had the participants describe (via the post-experiment survey) how they would react if they experienced the hypothetical scenario for two hours.

The 12 scenarios were manipulations of three hypothetical hedonic experiences: a platform video game, a driving video game, and an adventure game. Each game had four variations that were intended to provide better and worse experiences to the participants through joy (low-high) and the quality/usability of the interaction (low-high), which we represent through PEOU. These are summarized in Table 2. The actual scripts for all the scenarios for Study 1 are in Appendix C.

**Table 2. Summary of Study 1 Game Scenarios**

| Scenario | Type | Expected joy | Expected PEOU |
|---|---|---|---|
| 1.1 | platform | Low | Low |
| 1.2 | platform | Low | High |
| 1.3 | platform | High | Low |
| 1.4 | platform | High | High |
| 2.1 | driving | Low | Low |
| 2.2 | driving | Low | High |
| 2.3 | driving | High | Low |
| 2.4 | driving | High | High |
| 3.1 | adventure | Low | Low |
| 3.2 | adventure | Low | High |
| 3.3 | adventure | High | Low |
| 3.4 | adventure | High | High |

A second study was conducted that built on the results of Study 1. Study 2 was a controlled laboratory experiment in which participants were randomly assigned to play, for 15 minutes, one of four commercial games selected to represent different levels of PEOU and joy. Table 3 summarizes these games and their expected levels of joy and PEOU. Appendix C provides screenshots and detailed descriptions of the games.

**Table 3. Summary of Study 2 Games**

| Game # | Game name | Expected joy | Expected PEOU |
|---|---|---|---|
| 1 | Hitchhiker's Guide | Low | Low |
| 2 | Bubble Shooter | High | Low |
| 3 | Shooting Fish | Low | High |
| 4 | Black Knight | High | High |

Because we had no theoretical reason to believe that any particular low-joy vs. high-joy vs. low-PEOU vs. high-PEOU combination would be more effective than another (and it was not the purpose of our study to necessarily establish one game as more enjoyable than another), we combined all the "low" and "high" manipulations to ensure that our scenarios would have the expected overall effect on the model. Table 4 summarizes these manipulations. MANOVA was used to determine whether the differences in the means were significant. The manipulation checks in both studies were significant for joy (Study 1: $F_{(1,243)}$=147.08, $p$=0.000; Study 2: $F_{(1,212)}$=18.80, $p$=0.000) and PEOU (Study 1: $F_{(1,243)}$=100.61, $p$=0.000; Study 2: $F_{(1,212)}$=88.53, $p$=0.000). We thus concluded that our manipulations provided the desired variation in both studies.

**Table 4. Manipulation Averages for Study 1 and Study 2**

| Manipulation | Study 1: μ (SD) | Study 2: μ (SD) |
|---|---|---|
| Low-joy | 2.10 (1.49) | 4.24 (1.43) |
| High-joy | 4.23 (2.00) | 5.08 (1.15) |
| Low-PEOU | 3.51 (1.25) | 4.22 (1.52) |
| High-PEOU | 5.13 (1.29) | 5.53 (0.73) |

## 5.2 Study Participants

A total of 243 participants from a large private university in the western United States were involved in Study 1.[9] Participants were primarily students from a second-level introductory IS course, humanities courses, and English courses. Study 1 demographics were as follows: age (μ=21.85, SD=2.98) and number of years of college (μ=2.46, SD=0.88), with the gender distribution 73.3% men, 25.5% women, and 1.2% not reported. A total of 212 students participated in Study 2. Of these, 100 participants were students at a large private university in the western United States, and 112 participants were students at a large public university in the southeastern United States. All participants were from sophomore-level introductory IS courses at these schools. Study 2 demographics were as follows: age (μ=21.36, SD=2.82) and number of years of college (μ=2.12, SD=1.0), with the gender distribution 64.6% men, 34.9% women, and 0.5% not reported.

## 5.3 Measures

Appendix A summarizes the pre-experiment and post-experiment measures, which were the same for both studies. The pre-experiment data (i.e., participants' demographic data) were gathered approximately 10 days before the students participated in the experiment. We performed this as part of a sign-up process for the experiment to reduce test-retest fatigue, to reduce testing threats to validity, and to decrease the potential for common method bias.

## 5.4 Pilot Test

We started by reviewing and preliminarily rating the interactivity of more than 50 potential games and selected the 8 most promising games. We then conducted a pilot test of our experiment with 30 participants, each of whom played multiple games for a total of 131 data records. This allowed participants to compare various gaming experiences and resulted in the selection of the four games that were the most promising in terms of creating variation in PEOU that would subsequently impact joy[10].

[9] We pilot tested all scenarios with an additional 100 participants before Study 1 was run. An EFA of the pilot test data confirmed that our measures grouped as expected, and some preliminary regression analyses supported expected relationships.

[10] The following four games were selected: The Hitchhiker's Guide to the Galaxy (low PEOU and low joy), Bubble Shooter (low PEOU and moderate joy), Black Knight (moderate PEOU and moderate-high joy), and Shooting Fish (high PEOU and high joy).

## 6. Analysis

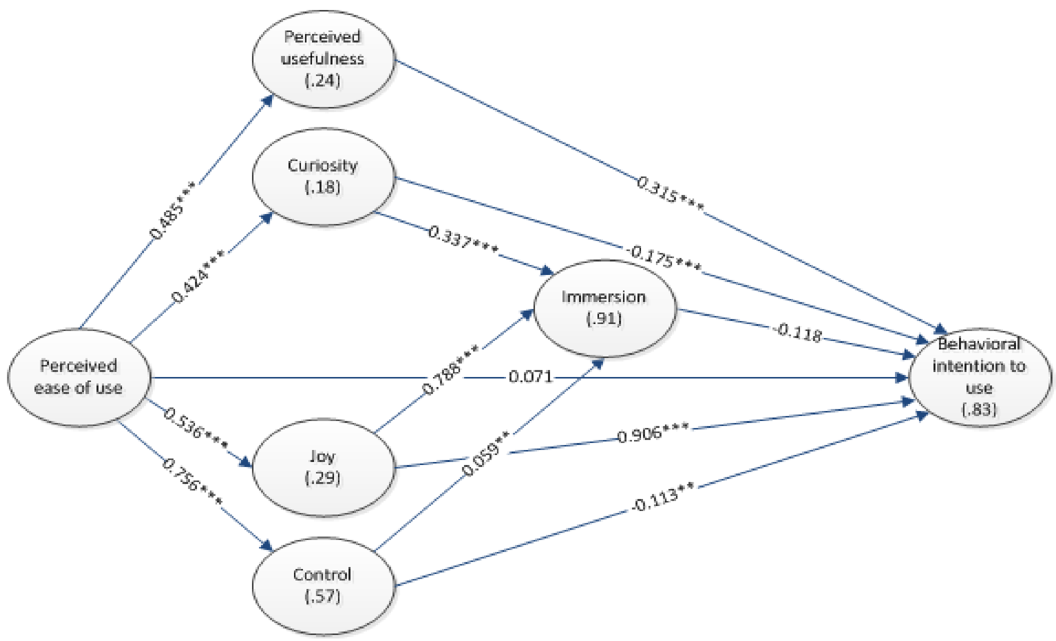
We analyzed our theoretical model using maximum likelihood parameter estimation in covariance-based SEM (CBSEM). We used AMOS to conduct this analysis. One important motivation for using CBSEM was that it affords the ability to test model differences by comparing model fit indices (Gefen, Straub, & Rigdon, 2011), which is necessary for determining the relative value of the HMSAM and alternative models. Online Appendix B documents the procedures we performed to validate the HMSAM. Our procedures included tests for the convergent and discriminant validity of the scales. To establish convergent validity, three criteria must be met: model fit must be adequate, lambda values must be significant and greater than 0.30, and the average variance extracted (AVE) must exceed 0.50 (Hair, Black, Babin, & Anderson, 2010). All three criteria were met for both studies. For assessing model fit, Hu and Bentler (1999) recommend a comparative fit index (CFI) ≥ 0.95, standardized root mean square residual (SRMR) ≤ 0.08, and a root mean square error of approximation (RMSEA) ≤ 0.06 (Gefen et al., 2011). Overall, the samples from both studies revealed good fit. We relied on the Fornell-Larcker test to establish discriminant validity, which requires that the square root AVE for each construct is greater than any inter-construct correlations (Fornell & Larcker, 1981). All constructs from both studies met this criterion, with borderline exceptions for PEOU in Study 1 and for PU in Study 2.

To establish reliability, we used composite reliability, or rho. This score is a more accurate measurement of reliability than Cronbach's alpha because the former does not assume that the loadings or error terms of the items are equal (Chin, Marcolin, & Newsted, 2003). Each construct in our research model met the standard minimum threshold of 0.7 (see Table 5). Finally, we checked the experimental manipulations to ensure that the observed effects were in the correct direction (as shown previously in Table 4).

**Table 5. Composite Reliability Scores**

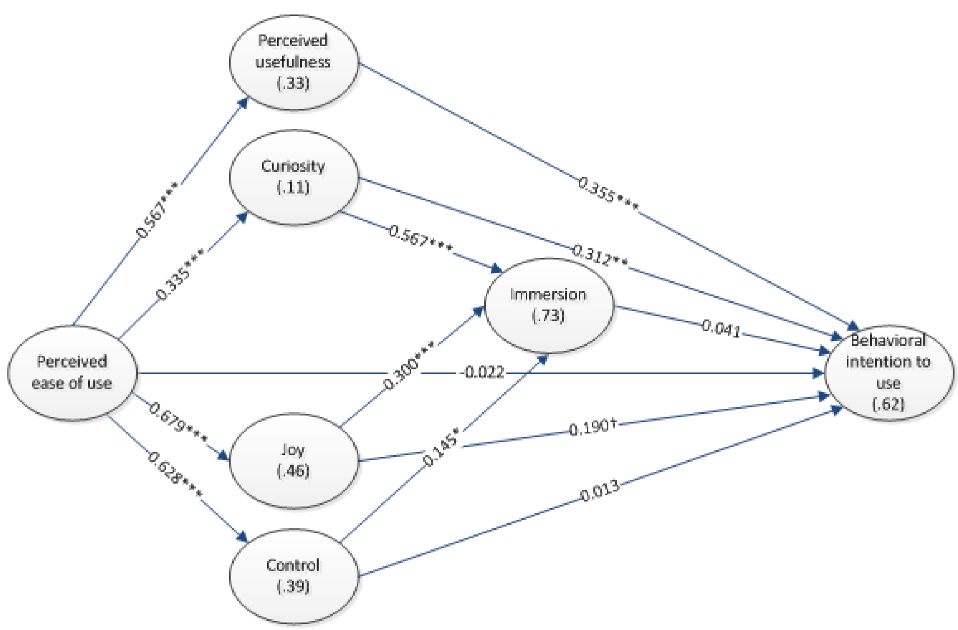
| Latent variable | Study 1 ρ | Study 2 ρ |
|---|---|---|
| Perceived ease of use | 0.872 | 0.953 |
| Joy | 0.981 | 0.938 |
| Control | 0.962 | 0.886 |
| Curiosity | 0.966 | 0.922 |
| Intention | 0.984 | 0.957 |
| Perceived usefulness | 0.940 | 0.893 |
| Immersion | 0.950 | 0.836 |

Because we collected data for our dependent and independent variables using a single online survey, we tested for common methods bias. To do so, we employed the "unmeasured latent factor method" suggested by Podsakoff, MacKenzie, Lee, and Podsakoff (2003) to extract the common variance. This procedure requires the addition of an unmeasured latent factor to the measurement model during confirmatory factor analysis. This latent factor includes all indicators from all other latent factors. This approach detects the variance common among all observed indicators. The indicator loadings on this common latent factor are constrained to be equal to each other to ensure that the unstandardized loadings will be equal. Squaring the unstandardized loading (which for all indicators will be the same value) then gives the percent of common variance across all indicators in the model. This value is the common method bias. By retaining this common latent factor in the consequent structural model, we can effectively control for the effect of common methods bias on our results. The results of this test showed that 68 percent of the variance could be due to common method bias for Study 1 and 38 percent for Study 2. From these analyses, we concluded that common methods bias was not a serious concern for Study 2 but could affect Study 1. These differences are not too surprising, given that the first study involved no actual user interaction, whereas Study 2 involved fully interactive gaming. Given the potential for common method bias in Study 1, the analysis presented in Figure 4a includes values adjusted for the common methods variance. Figure 4b represents the non-adjusted results for Study 2.




*p*<0.10, **p*<0.05, ***p*<0.01, ****p*<0.001

**Figure 4a. Study 1 results with CMV-corrected values**




†*p*<0.10, **p*<0.05, ***p*<0.01, ****p*<0.001

**Figure 4b. Results from Study 2**

The next step in our analysis was to compare our proposed model with van der Heijden's (2004) original model and to an alternative model that includes CA as a single second-order construct to establish the need for the HMSAM as an improved model for predicting BIU in a hedonic context. Figures 5a and 5b show the path analysis of these two models using the data from Study 2. Taken together, CA has a significant relationship with BIU in the alternative model. However, in our proposed model, not all the relationships between the CA sub-constructs and BIU are significant (Figure 5). This analysis offers evidence for separating CA into its sub-constructs because the results provide a more accurate assessment of what actually affects BIU. Note also that, in the van der Heijden model, joy is a strong predictor of BIU; by contrast, the effect is weaker in the HMSAM, where joy is just one of many predictors of BIU. To gather further evidence that the HMSAM has better predictive validity than the other two models, we compared measures of fit between these two models and the HMSAM (see Table 6). Tanriverdi (2005) performed such a comparison when establishing the preference of a proposed model over alternatives. The HMSAM shows better fit for all measures when compared to either of the alternative models. This provides support for our view that the sub-constructs of CA should be conceptualized as discrete constructs, and that the HMSAM is a more-accurate model for testing theories of system use in a hedonic context.

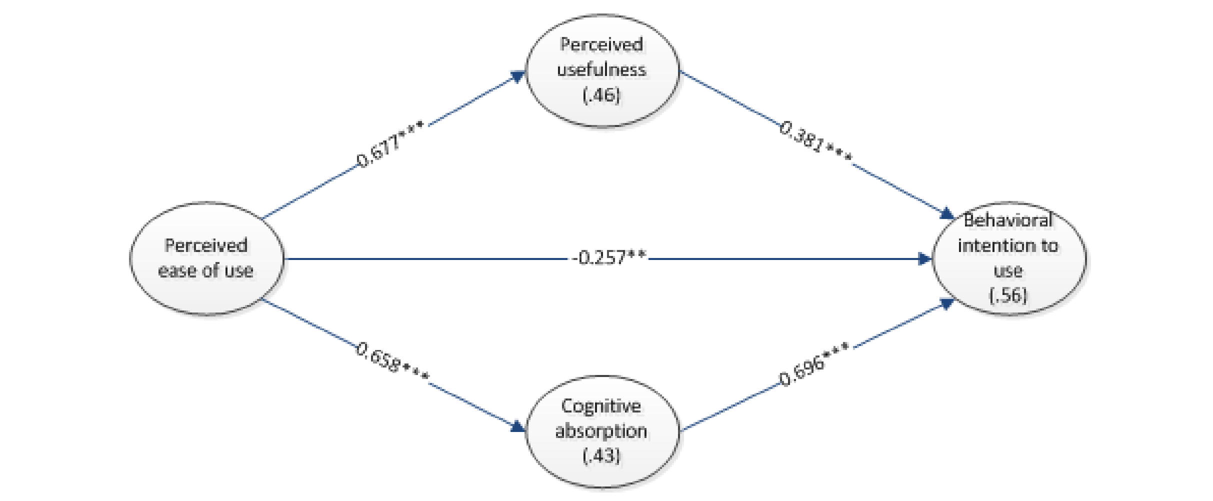



**Figure 5a. Results of an Alternative Model (Combining CA)**

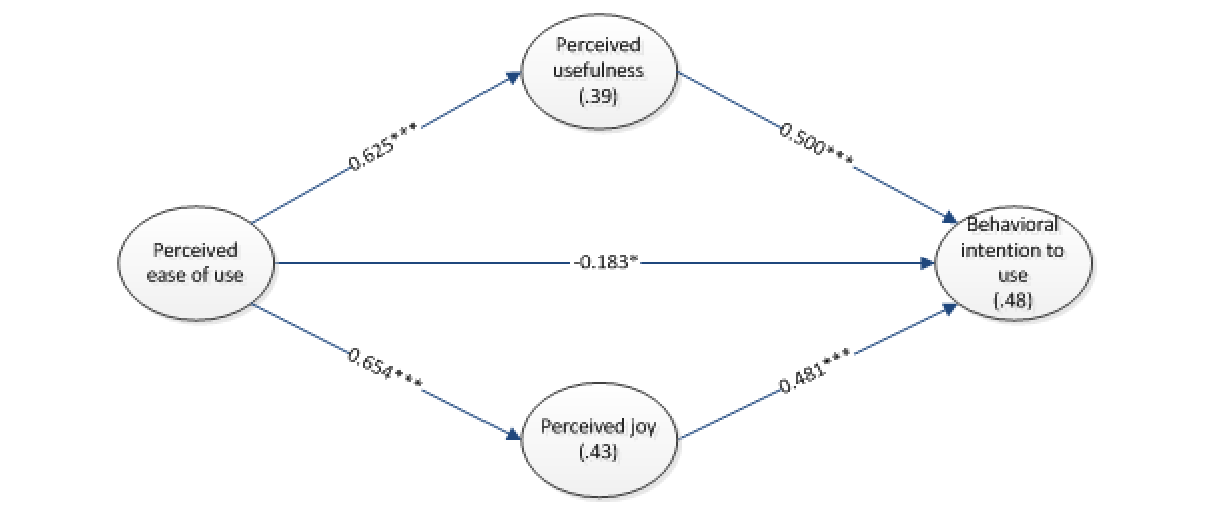



**Figure 5b. Results for the van der Heijden Model**

**Table 6. Model Fit Comparisons Between Models**

| | Study 1 | | Study 2 | |
|---|---|---|---|---|
| | van der Heijden model | Proposed HMSAM model | van der Heijden model | Proposed HMSAM model |
| CFI | 0.927 | 0.952 | 0.931 | 0.960 |
| SRMR | 0.116 | 0.054 | 0.115 | 0.051 |
| RMSEA | 0.066 | 0.054 | 0.091 | 0.054 |

# 7. Discussion

We have sought to discover the salient predictors of acceptance of HMS, which include console games, online video games, social networking applications, and virtual worlds designed for entertainment and leisure. Prior IS studies on hedonic drivers of acceptance have focused primarily on UMS or MMS. However, the motivations to use HMS differ from motivations to use UMS and MMS; thus, research on the acceptance of HMS would benefit from a model designed specifically for HMS. Addressing this opportunity, we built on van der Heijden's (2004) model by replacing joy with CA and using each CA sub-construct separately. The results of the two experiments conducted in this study largely overlapped, though all of the $R^2$s were much higher for the constructs in the first experiment (storyboards). Based on the results, we conclude that it is best to represent PEOU not as a direct predictor of BIU, but one that is fully mediated by joy, PU, and curiosity. Although both joy and curiosity appear to increase immersion and BIU, control increases only immersion. As expected, PU had a significant impact on BIU; but contrary to our hypothesis, immersion had no significant impact on BIU. Figure 6 depicts our final suggested version of the HMSAM.

## 7.1 Contributions to Research and Practice

Our primary contribution is to propose and provide empirical support for a new theoretical model, the HMSAM, which was found to be better at predicting BIU for HMS than existing technology acceptance models. This theoretical focus allows us to make key contributions to research and practice. By replacing joy with the more expansive intrinsic motivation construct of CA, which includes joy as a sub-construct, we represent intrinsic motivation in HMS usage more comprehensively than previous research has because joy is just one of several possible intrinsic motivations in this context.
Moreover, we conceptualize intrinsic motivation as the sub-constructs of CA, as was originally intended in flow theory, on which CA is based[11]. This application of intrinsic motivation provides a theoretical improvement because, in reality, joy, curiosity, control, and immersion do not necessarily appear together, appear at the same time, or have the same theoretical antecedents or causal mechanisms. Our empirical results confirm this theoretical position. This improved modeling provides a better understanding of which constructs contribute the most and least to BIU for a particular HMS. In our data collections, joy and curiosity played a substantial role in predicting that BIU and PEOU did not contribute to BIU directly at all; instead, it was fully mediated by PU, joy, and curiosity. Control and immersion had no significant impact on BIU. Had we retained CA as a second-order theoretical black box, we could not have gained this detailed understanding of which CA dimensions truly contributed to BIU or of the extent of their contributions.

As a further contribution—one that challenges extant research and practice—although PEOU (when accounted for alone) explained 18.3 percent of the variance in BIU using a traditional TAM approach, PEOU completely drops out as a predictor of BIU when control, joy, and curiosity are included in the

[11] Interestingly, a utilitarian study also separated the sub-constructs of CA (Rutkowski, Saunders, Vogel, & Van Genuchten, 2007); however, the authors of that study separated the sub-constructs quite differently from the way they were separated in the HMSAM. They separated only temporal dissociation and immersion to determine the distinct effects each has on interpersonal conflict and team performance; by contrast, in our study, we separated the other CA sub-constructs but left immersion and temporal dissociation together. We kept them together due to their synchronous effect on BIU (an issue of temporality), whereas Rutkowski et al. separated immersion and temporal association to distinguish between their separate causal effects (an issue of variance).

model. A possible explanation is that PEOU is expected and necessary, but not sufficient in an HMS context. This is not to say that PEOU is unimportant in HMS, but rather that PEOU's effects on BIU and immersion are fully mediated by curiosity, control, PU, and joy. This is a major finding because models and related empirical studies involving UMS and MMS have shown that PEOU plays a direct positive role in determining BIU (e.g., Agarwal & Karahanna, 2000; Agarwal & Venkatesh, 2002; Davis, 1989; Davis et al., 1989; Davis, Bagozzi, & Warshaw, 1992; Hsu & Lu, 2007; Koufaris, 2002; Saade & Bahli, 2005; Sun & Zhang, 2006; Venkatesh, 1999). Although the HMSAM and the results appear to challenge these important studies, we believe our findings in no way contradict these studies. By focusing on a context-specific HMS acceptance model and including dimensions of intrinsic motivation beyond joy, we clarify the contribution and role of PEOU in predicting BIU in HMS use. We do not invalidate the extant research related to PEOU; rather, we clarify this research for HMS use.

Due to the nature of the HMSAM, we were able to test it in two different kinds of experiments—one involving a thought experiment with storyboards and scenarios, and the other using a traditional laboratory experiment with actual systems. In addition to establishing increased generalizability of the HMSAM, this approach provides several additional benefits for research and practice. Storyboarding and scenarios have long been prevalent as a cost-effective means in the film industry to work through proofs of concept on the screenplay, set, and design of films, without going through the costly process of filming only to discover that the storyline, visuals, and so on do not work together (Feld, 1994; McKee, 1997). Because HMS similarly involve stories and require an accepting, engaged audience, HMS designers have also begun to employ storyboards as a fundamental part of HMS (e.g., Cilella et al., 2010; Jhala et al., 2005; Kim, 2005; Pardew, 2004; Robertson & Good, 2005; Schewe & Thalheim, 2008) and even of UMS (e.g., Carbonaro et al., 2008; Goldman, Curless, Salesin, & Seitz, 2006; Gruen, 2000; Hall, Woods, Dautenhahn, & Sobreperez, 2004; Jones, 2008; Kim, 2005; Madsen & Aiken, 1993; Robertson & Good, 2005; Schewe & Thalheim, 2007; Sutherland & Maiden, 2010; Thorne, Burke, & Panne, 2004). Storyboarding and scenarios are a natural addition to the highly important systems prototyping process (Rudd, Stern, & Isensee, 1996) because potential end-users can be easily engaged in the design process through role-playing or highly structured empirical thought experiments (Iacucci, Kuutti, & Ranta, 2000; Jones, 2008). For our theoretical improvements to benefit practice, they must be applicable to how practice works, which involves storyboarding. Hence, it is highly useful for practitioners to know that the HMSAM generally holds for storyboarding, though more work is necessary to ensure that common method bias does not creep into such approaches, as we explain in Section 7.2.

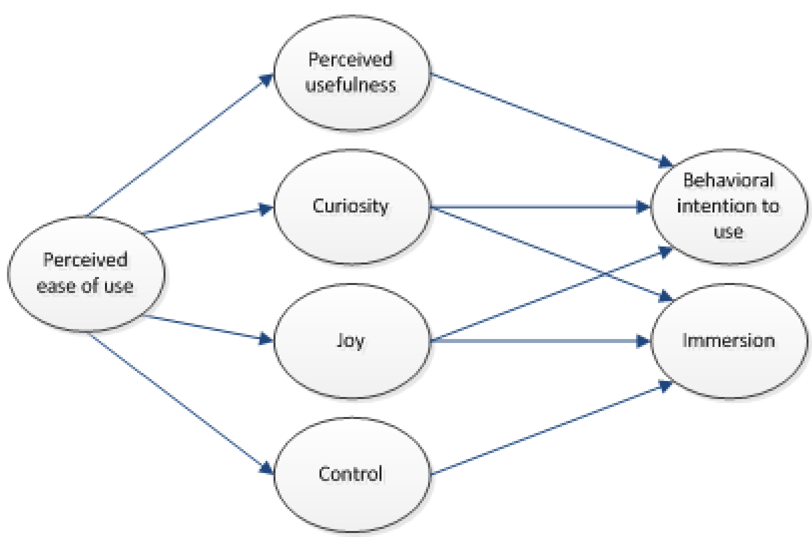



**Figure 6. Final Proposed Model: HMSAM (Significant Paths Only)**

## 7.2 Limitations and Future Research

Testing the HMSAM in two different types of experiments was useful. However, our empirical results also serve as a warning that common methods bias might more strongly affect storyboard testing and thought experiments than experiments with actual software. We found that this bias distorted the strength of the tested relationships, but we were able to correct for bias by including common methods bias in the affected Study 1 model. The potential weakness in storyboarding and thought experiments is thus that participants might overestimate the strength and salience of the relationships in their minds—perhaps due to an absence of actual interaction with the system. Thus, results might be more accurate with actual HMS use. However, storyboards and thought experiments are more cost-effective than prototypes and fully developed HMS.

A second area for future research is further exploration of the benefits of immersion. Although many HMS studies have touted the importance of immersion in HMS, our findings showed no direct connection between immersion and BIU. Future research needs to corroborate our findings that the precursors of immersion are more important than immersion itself. Alternatively, including additional intrinsic motivation in HMS acceptance might illuminate the role of immersion in HMS more effectively. Although we investigated intrinsic motivations beyond joy, our study did not represent the full range of intrinsic motivations that are possible with HMS use, which could also include motivations to escape pressures (Joines et al., 2003; Yee, 2006), engage in challenge (Foltz, 2004; Vorderer et al., 2003), and discover novel things (Barnes, 2007; Yee, 2006). Some intrinsic motivations beyond those encompassed by CA were likely captured by PU, which was framed as usefulness in an HMS context in this study. Further research could illuminate the relationship between cognitive and hedonic motivations in HMS. Given the relationship between motivations and affect, we believe that further considering the effects of emotions on HMS acceptance is promising—as has been recently investigated in a UMS (banking system) study examining the effects of anxiety, anger, happiness, and excitement on system acceptance (Beaudry & Pinsonneault, 2010).

A final limitation that indicates compelling research opportunities is the HMSAM's exclusive focus on individual use of HMS; in fact, several kinds of HMS are designed for groups and online communities—such as massive multiplayer online games, multiplayer console games, virtual world communities, social networks, and even some forms of blogging. Group- and community-oriented HMS are increasingly prevalent, and they introduce other motivations that likely have an increasing relevance and that have already been established as relevant in UMS and MMS research—including motivations related to enhanced interactivity, culture, peer influence, and self-disclosure (Lowry, Cao, & Everard, 2011; Lowry et al., 2009; Posey, Lowry, Roberts, & Ellis, 2010; Zhang, Gaskin, & Lowry 2009; Zhang, Lowry, Zhou, & Fu, 2007); expressing oneself (Hsu & Lu, 2004; Li et al., 2005; Premkumar et al., 2008; Wasko & Faraj, 2000); developing peer companionship (Davis et al., 2009; Oksman & Turtiainen, 2004; Ryan et al., 2006); seeking coordination (Lowry, Curtis, & Lowry, 2005; Lowry, Roberts, Dean, & Marakas, 2009; Malone & Crowston, 1994); and receiving approval from others (Butler et al., 2002; McClure et al., 2009).

Given the rapidly growing demand and social impact of HMS, such systems deserve a more prominent place in IS research. Some qualities in these HMS create such intense demand that their adoption can result in life-altering behavior—even addiction—and the willingness of individuals to collectively spend billions of dollars and countless hours on their use. The design implications of the HMS revolution do not necessarily apply to HMS only. Leveraging these factors toward UMS could be immensely beneficial. If UMS designers can better tap into their users' intrinsic motivations, the designers could achieve a devoted following in use of their software that would trump system use driven by extrinsic motivation (Barab, Thomas, Dodge, Carteaux, Tuzun, 2005; Carroll, 2004; Foreman et al., 2004; Litman, 2005). It is likely that this partially explains the phenomenal success of the iPhone™ and the iPad™: Apple has clearly understood the importance of the intrinsic motivations of its consumers. As people increasingly expect to enjoy system use (e.g., Prensky, 2001; Prensky, 2009), intrinsic motivation will likely play a stronger role in UMS use and development (Davis et al., 1992; van der Heijden, 2003; Venkatesh, 1999). With careful design, UMS development can benefit from taking advantage of the capacity of hedonic factors to provide intrinsic usage motivation (Barab et al., 2005; Carroll, 2004; Foreman et al., 2004; Litman, 2005).

## 8. Conclusion

Research and design opportunities abound in the HMS domain, and our aim was to gain a better conceptual understanding of HMS use. We have built, supported, and tested a new model, the HMSAM, to explain intentions to use HMS. The HMSAM improves on existing models for predicting HMS use by considering more intrinsic motivations and explaining the relationships between these motivations and traditional technology acceptance factors. We find support for the proposition that it is more effective to examine the components of CA independently than as a single second-order construct. Separating the CA components reveals that the relationship between PEOU and BIU is fully mediated by those components. A comparison with alternative models suggests that this approach increases predictive validity. We also found support for the value of storyboarding and thought experiments in predicting BIU in HMS, though such methods may introduce the risk of biased results due to a lack of actual interaction between users and systems. Like other studies, the HMSAM confirms joy as a stronger predictor of BIU than PU.

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# Appendices

## Appendix A. Measurement Scales

**Table A-1. Measurement Scales Table**

| Construct | Items | Notes |
|---|---|---|
| Joy | **JOY1**. I found playing the game to be enjoyable. | Built on the original three-item scale from (Venkatesh, 2000) by modifying to gaming context and added three items based on hedonic enjoyment concepts from the following literature: (Agarwal & Karahanna, 2000; Igbaria, Iivari, & Maragahh, 1995; Raney, Arpan, Pashupati, & Brill, 2003; van der Heijden, 2004). |
| | **JOY2**. I had fun using the game. | |
| | ***JOY3**. Using the game was boring. | |
| | ***JOY4**. The game really annoyed me | |
| | **JOY5**. The game experience was pleasurable. | |
| | ***JOY6**. The game left me unsatisfied. | |
| Control | **CTL1**. I had a lot of control. | Modified original scale from (Liu, 2003) to be more general so that it did not focus solely on Web sites. Also, added items on control from (Agarwal & Karahanna, 2000). |
| | **CTL2**. I could choose freely what I wanted to see or do. | |
| | ***CTL3**. I had little control over what I could do. | |
| | **CTL4**. I was in control. | |
| | ***CTL5**. I had no control over my interaction. | |
| | **CTL6**. I was allowed to control my interaction. | |
| Focused Immersion | **FI1.** I was able to block out most other distractions. | Modified original scale from (Agarwal & Karahanna, 2000) to a gaming context; third item was changed from task to game. |
| | **FI2.** I was absorbed in what I was doing. | |
| | **FI3.** I was immersed in the game. | |
| | ***FI4.** I was distracted by other attentions very easily. | |
| | **(d1)(d2) FI5.** My attention was not diverted very easily. | |
| Temporal Dissociation | **TD1.** Time appeared to go by very quickly using the game. | Modified original scale from (Agarwal & Karahanna, 2000) to a gaming context; last two original items were not included because they did not fit our context. |
| | **TD2.** I lost track of time when I was playing the game. | |
| | **TD3.** Time "flew" when I played the game. | |
| Curiosity | **CUR1.** This experience excited my curiosity. | Modified original scale from (Agarwal & Karahanna, 2000) to a gaming context. |
| | **CUR2.** This experience made me curious. | |
| | **CUR3.** This experience aroused my imagination. | |

**Table A-1. Measurement Scales Table (cont.)**

| Construct | Items | Notes |
|---|---|---|
| Perceived Ease-of-Use | **PEOU1**. My interaction with the game was clear and understandable. | Combined four-item scale from (Agarwal & Karahanna, 2000) and four-item scale from (Venkatesh, 2000) and modified to a gaming context. |
| | **PEOU2**. Interacting with the game did not require a lot of my mental effort. | |
| | **PEOU3**. I found the game to be trouble free. | |
| | **PEOU4**. I found it easy to get the game to do what I want it to do. | |
| | **(d1) PEOU5**. Learning to operate the game was easy for me. | |
| | **PEOU6**. It was simple to do what I wanted with the game. | |
| | **PEOU7**. It was be easy for me to become skillful at using the game. | |
| | **PEOU8.** I found the game easy to use. | |
| Perceived Usefulness | **PU1.** The game decreased my stress. | Modified original utilitarian scale from (Venkatesh, 2000) to a hedonic context. Items chosen from pilot test items that showed the strongest benefits of fun. |
| | **PU2.** The game helped me better pass time. | |
| | **PU3.** The game provided a useful escape. | |
| | **PU4.** The game helped me think more clearly. | |
| | **PU5.** The game helped me feel rejuvenated. | |
| Behavioral Intention to Use | **BIU1.** I would plan on using it in the future. | Modified original scale from (Agarwal & Karahanna, 2000) to a gaming context |
| | **BIU2.** I would intend to continue using it in the future. | |
| | **BIU3.** I expect my use of it to continue in the future. | |

Notes on measures:

*=reverse scaled; d1=dropped for Study 1

All scales were reflective and used a Likert-like seven-point scale anchored on “Strongly Disagree” to “Strongly Agree.”

The post-experiment measures were virtually the same for both Study 1 and Study 2. However, since Study 1 required the participants to imagine the games rather than actually play them, all prompts were changed to be conditional (e.g., “I would” instead of “I was”). To get participants in Study 1 to imagine the effects of the games more vividly, we asked them to imagine playing their assigned game for two hours.

# Appendix B. Analysis Support

## Convergent Validity

To establish convergent validity three criteria must be met: model fit must be adequate, lambda values must be significant and greater than 3.0, and the average variance extracted (AVE) must exceed 0.50 (Hair et al., 2010). Table B-1 provides the fit indices for Study 1 and Study 2. For the comparative fit index (CFI) Hu and Bentler (1999) recommend a CFI ≥ 0.95 for acceptable fit. Both Study 1 and Study 2 achieve the recommended levels of fit. For the standardized root mean square residual (SRMR), Hu and Bentler (1999) recommend SRMR ≤ 0.08 for acceptable fit. Each sample is at that threshold. Hu and Bentler (1999) recommend a root mean square error of approximation (RMSEA) ≤ 0.06. Again, both samples achieve this recommended value. Overall, the samples from both studies reveal adequate fit.

**Table B-1. Fit Indices**

| | Study 1 | Study 2 |
|---|---|---|
| CFI | 0.970 | 0.954 |
| SRMR | 0.044 | 0.056 |
| RMSEA | 0.054 | 0.053 |

Table B-2 shows the standardized lambda values with their respective p-values. According to the results of in Table B-2, all lambdas exceed 0.50 and are significant. Thus, both studies pass this criterion for convergent validity.

**Table B-2. Assessment of Indicators**

| Items | Study 1 | | Study 2 | |
|---|---|---|---|---|
| | Lambdas | p-values | Lambdas | p-values |
| biu1 | 0.974 | < 0.000 | 0.897 | < 0.000 |
| biu2 | 0.995 | < 0.000 | 0.972 | < 0.000 |
| biu3 | 0.959 | < 0.000 | 0.947 | < 0.000 |
| ctl1 | 0.945 | < 0.000 | 0.804 | < 0.000 |
| ctl2 | 0.903 | < 0.000 | 0.773 | < 0.000 |
| ctl3 | 0.887 | < 0.000 | 0.741 | < 0.000 |
| ctl4 | 0.936 | < 0.000 | 0.820 | < 0.000 |
| ctl5 | 0.883 | < 0.000 | 0.663 | < 0.000 |
| ctl6 | 0.836 | < 0.000 | 0.700 | < 0.000 |
| cur1 | 0.977 | < 0.000 | 0.962 | < 0.000 |
| cur2 | 0.971 | < 0.000 | 0.920 | < 0.000 |
| cur3 | 0.902 | < 0.000 | 0.790 | < 0.000 |
| fi1 | 0.901 | < 0.000 | 0.620 | < 0.000 |
| fi2 | 0.983 | < 0.000 | 0.907 | < 0.000 |
| fi3 | 0.974 | < 0.000 | 0.957 | < 0.000 |
| fi4 | 0.778 | < 0.000 | 0.603 | < 0.000 |

**Table B-2. Assessment of Indicators (cont.)**

| Items | Study 1 | | Study 2 | |
|---|---|---|---|---|
| | Lambdas | p-values | Lambdas | p-values |
| fi5 | - | - | - | - |
| joy1 | 0.982 | < 0.000 | 0.956 | < 0.000 |
| joy2 | 0.983 | < 0.000 | 0.973 | < 0.000 |
| joy3 | 0.936 | < 0.000 | 0.833 | < 0.000 |
| joy4 | 0.913 | < 0.000 | 0.764 | < 0.000 |
| joy5 | 0.956 | < 0.000 | 0.874 | < 0.000 |
| joy6 | 0.904 | < 0.000 | 0.645 | < 0.000 |
| peou1 | 0.716 | < 0.000 | 0.855 | < 0.000 |
| peou3 | 0.667 | < 0.000 | 0.825 | < 0.000 |
| peou4 | 0.937 | < 0.000 | 0.817 | < 0.000 |
| peou5 | - | - | 0.871 | < 0.000 |
| peou6 | 0.859 | < 0.000 | 0.933 | < 0.000 |
| peou7 | 0.568 | < 0.000 | 0.850 | < 0.000 |
| peou8 | 0.586 | < 0.000 | 0.872 | < 0.000 |
| pu1 | 0.854 | < 0.000 | 0.773 | < 0.000 |
| pu2 | 0.792 | < 0.000 | 0.732 | < 0.000 |
| pu3 | 0.916 | < 0.000 | 0.854 | < 0.000 |
| pu4 | 0.892 | < 0.000 | 0.750 | < 0.000 |
| pu5 | 0.893 | < 0.000 | 0.843 | < 0.000 |
| td1 | 0.961 | < 0.000 | 0.879 | < 0.000 |
| td2 | 0.952 | < 0.000 | 0.888 | < 0.000 |
| td3 | 0.960 | < 0.000 | 0.912 | < 0.000 |
| FI | 0.934 | < 0.000 | 0.866 | < 0.000 |
| TD | 0.969 | < 0.000 | 0.828 | < 0.000 |

A third, more-recent criteria for assessing convergent validity is the AVE for the latent variable must exceed 0.50 (Kline et al., 2011). All of the latent variables meet these criteria. Overall, the latent variables achieve convergent validity. These are summarized in Table B-3.

| Table B-3. Average Variance Extracted | | |
|---|---|---|
| **Constructs** | **Study 1** | **Study 2** |
| Perceived Ease of Use | 0.540 | 0.742 |
| Joy | 0.895 | 0.720 |
| Control | 0.808 | 0.566 |
| Curiosity | 0.904 | 0.799 |
| Intention | 0.953 | 0.882 |
| Perceived Usefulness | 0.758 | 0.627 |
| Immersion | 0.906 | 0.718 |

## Discriminant Validity

Using the Fornell-Larcker test to establish discriminant validity, the square root AVE for each construct must be greater than any inter-construct correlations (Fornell & Larcker, 1981). All constructs from both studies met this criterion with two borderline exceptions of PEOU in Study 1 and PU in Study 2 (see Tables B-4 and B-5, respectively).

| Table B-4. Discriminant Validity through AVE Analysis, Study 1 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Constructs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
| 1. PEOU | **0.735** | | | | | | |
| 2. Joy | 0.617*** | **0.946** | | | | | |
| 3. Control | 0.787*** | 0.709*** | **0.899** | | | | |
| 4. Curiosity | 0.536*** | 0.899*** | 0.691*** | **0.951** | | | |
| 5. Intention | 0.613*** | 0.890*** | 0.623*** | 0.778*** | **0.976** | | |
| 6. PU | 0.632*** | 0.846*** | 0.663*** | 0.799*** | 0.847*** | **0.870** | |
| 7. Immersion | 0.595*** | 0.945*** | 0.717*** | 0.906*** | 0.836*** | 0.833*** | **0.952** |
| ****p<0.001; **p<0.01; *p<0.05;* Square root of AVE on the diagonal | | | | | | | |

**Table B-5. Discriminant Validity through AVE Analysis, Study 2**

| **Constructs** | **1** | **2** | **3** | **4** | **5** | **6** | **7** |
|---|---|---|---|---|---|---|---|
| 1. PEOU | **0.861** | | | | | | |
| 2. Joy | 0.661*** | **0.848** | | | | | |
| 3. Control | 0.585*** | 0.645*** | **0.752** | | | | |
| 4. Curiosity | 0.316*** | 0.654*** | 0.442*** | **0.894** | | | |
| 5. Intention | 0.414*** | 0.666*** | 0.445*** | 0.691*** | **0.939** | | |
| 6. PU | 0.638*** | 0.781*** | 0.522*** | 0.651*** | 0.701*** | **0.792** | |
| 7. Immersion | 0.513*** | 0.750*** | 0.570*** | 0.787*** | 0.682*** | 0.805*** | **0.847** |

****p<0.001; **p<0.01; *p<0.05;* Square root of AVE on the diagonal

# Appendix C. Scripts and Games Used for Study 1 and Study 2

## *Study 1: Scripts for all the Scenarios*

### *Scenario 1.1 (#1)*

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You're expecting that the game will be a lot of fun and that it will involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:

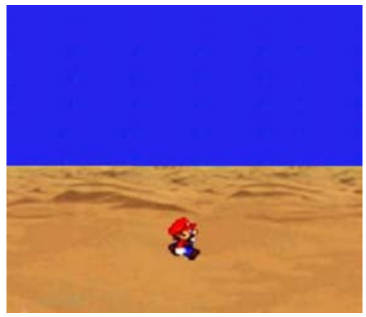

**Figure C-1. Scenario 1.1 (#1)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The game does not have any discernible purpose other than walking through a desert.
- It appears there is absolutely nothing else to do in the game besides walk around the world 100 times.
- As far as you can tell, the only landscape you can walk through is a desert that has little variation.
- You cannot find any interesting objects to examine.
- Each song in the soundtrack is performed very poorly, with occasional screeching noises.
- The graphics are very plain and unimaginative. They appear to have been done by a computer programmer, rather than an artist.
- Walking your character around the world just once takes two hours of your time.
- The level of challenge of the game is completely below your abilities.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The game isn't very responsive—it is an online game being played on a slow dial-up internet connection.
- Response time is so slow that when you press a direction on your controller to move your character, you must wait 5 seconds before the character responds.
- Even after the character responds, he doesn't always move in the direction you intended, or the amount of spaces you intended.
- He'll move up when you press left, or maybe he'll move right… He will move five spaces sometimes and only one space other times.
- Sometimes your character moves or jumps of his own accord—without any control on your part.
- The game never tells you the status of anything, including where you're at, the progress that you have made, how much time has passed, or how many points you have.
- There are no other characters in the game or human players you can play with or communicate with; you are completely isolated.

### *Scenario 1.2 (#2)*

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You're expecting that the game will be a lot of fun and that it will involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:

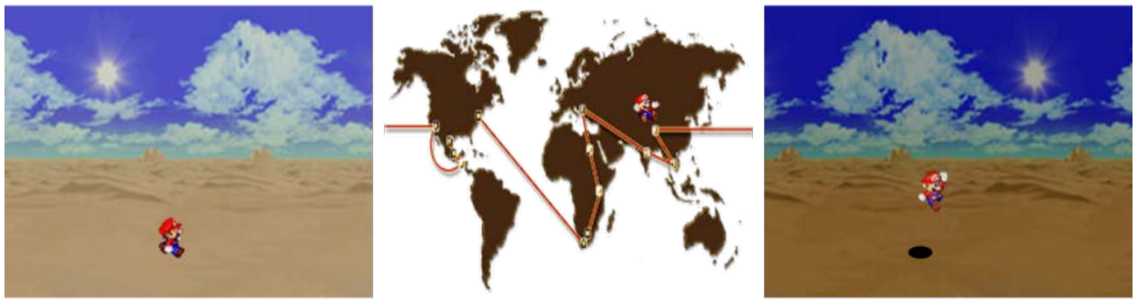

**Figure C-2. Scenario 1.2 (#2)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The game does not have any discernible purpose other than walking through a desert.
- It appears there is absolutely nothing else to do in the game besides walk around the world 100 times.
- As far as you can tell, the only landscape you can walk through is a desert that has little variation.
- You cannot find any interesting objects to examine.
- Each song in the soundtrack is performed very poorly, with occasional screeching noises.
- The graphics are very plain and unimaginative. They appear to have been done by a computer programmer, rather than an artist.
- Walking your character around the world just once takes two hours of your time.
- The level of challenge of the game is completely below your abilities.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The entire game is very responsive—it allows you to make your character crawl, walk, run, and jump in any direction on command.
- You feel like you're in complete control of your character.
- The response time is excellent—almost instantaneous.
- You have the freedom to do anything in any order you please.
- Every time you complete an adventure, the game immediately provides you with the option to play a new extension to the adventure you just completed.
- You may replay any part of the game any time that you want to.
- The system is so responsive it feels as though you are communicating with an actual person.
- If you want to, you can play with any number of human players over the Internet and talk to them about the game.
- You can talk to other players and fully communicate using a headset and microphone.
- You have the ability to socially connect with other gamers if you want to.
- The game continually gives you the status of everything—where you're at, how many points you have, how much time has passed, etc.
- By clicking a button, you can cause a map of the game's world to appear. Your character will automatically walk to any spot you select on the world map. Lines on the world map show you the course you've taken.

### *Scenario 1.3 (#3)*

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You're expecting that the game will be a lot of fun and that it will involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:

**Figure C-3. Scenario 1.3 (#3)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The purpose of this game is to experience various fun-filled adventures while you travel the world.
- The adventure storyline is like a well-written, captivating, and fascinating novel.
- The game is full of a variety of imaginative adventures such as flying, racing, performing magic, scaling mountains, treasure hunting, bargaining for rare jewels, exploring castles, defeating monsters, exploring underwater worlds, and creating magical towns.
- The game is carefully designed to be like a movie. Playing the game is like going to a place where a person can escape the real world and enter a care-free fantasy world.
- The game has amazing, vibrant, and colorful graphics that are fascinating just to look at.
- The sound effects are very professional and appropriate to the storyline.
- The music in the game is made up of some of your favorite songs.
- The level of challenge of the game is at the right level—not too hard or too easy.
- There is a very interesting storyline throughout the game that changes over time.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The game isn't very responsive—it is an online game being played on a slow dial-up internet connection.
- Response time is so slow that when you press a direction on your controller to move your character, you must wait 5 seconds before your character responds.
- Even after your character responds, he doesn't always move in the direction you intended, or the amount of spaces you intended.
- He'll move up when you press left, or maybe he'll move right… He will move five spaces sometimes and only one space other times.
- Sometimes your character moves or jumps of his own accord—without any control on your part.
- The game never tells you the status of anything, including where you're at, the progress that you have made, how much time has passed, or how many points you have.
- There are no other characters in the game or human players you can play with or communicate with; you are completely isolated.

## *Scenario 1.4 (#4)*

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You're expecting that the game will be a lot of fun and that it will involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:

**Figure C-4. Scenario 1.4 (#4)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The purpose of this game is to experience various fun-filled adventures while you travel the world.
- The adventure storyline is like a well-written, captivating, and fascinating novel.
- The game is full of a variety of imaginative adventures such as flying, racing, performing magic, scaling mountains, treasure hunting, bargaining for rare jewels, exploring castles, defeating monsters, exploring underwater worlds, and creating magical towns.
- The game is carefully designed to be like a movie. Playing the game is like going to a place where a person can escape the real world and enter a care-free fantasy world.
- The game has amazing, vibrant, and colorful graphics that are fascinating just to look at.
- The sound effects are very professional and appropriate to the storyline.
- The music in the game is made up of some of your favorite songs.

- The level of challenge of the game is at the right level—not too hard or too easy.
- There is a very interesting storyline throughout the game that changes over time.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The entire game is very responsive—it allows you to make your character crawl, walk, run, and jump in any direction on command.
- You feel like you're in complete control of your character.
- The response time is excellent—almost instantaneous.
- You have the freedom to do anything in any order you please.
- Every time you complete an adventure, the game immediately provides you with the option to play a new extension to the adventure you just completed.
- You may replay any part of the game any time that you want to.
- The system is so responsive it feels as though you are communicating with an actual person.
- If you want to, you can play with any number of human players over the Internet and talk to them about the game.
- You can talk to other players and fully communicate using a headset and microphone.
- You have the ability to socially connect with other gamers if you want to.
- The game continually gives you the status of everything—where you're at, how many points you have, how much time has passed, etc.
- By clicking a button, you can cause a map of the game's world to appear. Your character will automatically walk to any spot you select on the world map. Lines on the world map show you the course you've taken.

### *Scenario 2.1 (#5)*

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You expect the game to be a lot of fun and to involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:

**Figure C-5. Scenario 2.1 (#5)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- This is a go-kart racing game.
- At appears that the only thing you can do in this game is to race around the exact same circular track 500 times.

- The circular track has no variety to it—it's just a big circle.
- The setting of the track is a dry desert with only a few shrubs. The scenery virtually never changes.
- Each song in the soundtrack is performed very poorly, with occasional irritating screeching noises because it is recorded poorly.
- You drive around the same bland track without variation, over and over and over and over and over and over and over….
- The graphics are very plain and unprofessional; it's as if a junior high school student created them.
- Driving around the track just 100 times takes over two hours of your time.
- The driving simulation doesn't portray much realism: your go-kart doesn't make noise or give you a sense of speed, and the scenery doesn't change as it would if you were really driving a go-kart
- There is nothing to do besides driving your go-kart.
- The level of challenge of the game is completely below your abilities.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The game isn't very responsive—it is an online game that you play over a slow dial-up internet connection
- Response time is so slow that when you press a direction on your controller to move your go-kart, you must wait 5 seconds before the go-kart responds.
- The controls don't seem to work quite right—you can only control your go-kart occasionally.
- It is hard to predict exactly how the go-kart will move when you do operate the controls.
- You do not choose the game soundtrack, your character, or the kart—nearly everything is picked by the game for you.
- The game never tells you the status of anything, including where you're at, the progress that you have made, how much time has passed, or how many points you have.
- There are no other characters in the game or human players you can play with or communicate with; you are completely isolated.
- You don't know how fast you're going or your rank at any time during the race.

### *Scenario 2.2 (#6)*

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You expect the game to be a lot of fun and to involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:


**Figure C-6. Scenario 2.2 (#6)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- This is a go-kart racing game.
- At appears that the only thing you can do in this game is to race around the exact same circular track 500 times.
- The circular track has no variety to it—it's just a big circle.
- The setting of the track is a dry desert with only a few shrubs. The scenery virtually never changes.
- Each song in the soundtrack is performed very poorly, with occasional irritating screeching noises because it is recorded poorly.

- You drive around the same bland track without variation, over and over and over and over and over and over and over….
- The graphics are very plain and unprofessional; it's as if a junior high school student created them.
- Driving around the track 100 times takes over two hours of your time.
- The driving simulation doesn't portray much realism: your go-kart doesn't make noise or give you a sense of speed, and the scenery doesn't change as it would if you were really driving a go-kart
- There is nothing to do besides driving your go-kart.
- The level of challenge of the game is completely below your abilities.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The entire game is very responsive.
- You feel like you're in complete control of your go-kart.
- Your go-kart responds instantly and effortlessly to your controls.
- If you want to, you can play with any number of other players over the Internet.
- You can easily communicate with other human drivers by speaking over a headset, and you can clearly hear them respond.
- The game gives you lots of choices about what car you pick, which character you choose, etc.
- The go-kart in the game responds realistically, as if you're driving a real go-kart.
- You can choose to socially interact with other human players to discuss the game if you want to.
- You can also choose to listen to any song in the game soundtrack which includes hundreds of songs.
- The game continually gives you the status of everything: where you're at, how many points you have, how much time has passed, etc.
- There are dozens of computerized animals and creatures in the game that playfully race against you.

### Scenario 2.3 (#7)

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You expect the game to be a lot of fun and to involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:

**Figure C-7. Scenario 2.3 (#7)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- This is a go-kart racing game.

- The purpose of this game is to experience various fun-filled adventures while you race around different tracks in a variety of interesting settings.
- The game has amazing, vibrant, and colorful graphics that are fascinating just to look at.
- There is a very interesting storyline throughout the game that involves more than racing; it changes and gets more interesting over time.
- The sound effects are very professional and appropriate to the storyline.
- The music in the game is made up of some of your favorite songs.
- The game is carefully designed to be like a movie. Playing the game is like going to a place where a person can escape the real world and enter a care-free fantasy world.
- The game conveys a very high sense of realism: your go-kart makes realistic noises; you easily get a sense of speed, braking, and steering; and the scenery changes as you drive by.
- The level of challenge of the game is just right—not too hard and not too easy.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The game isn't very responsive—it is an online game that you play over a slow dial-up internet connection
- Response time is so slow that when you press a direction on your controller to move your go-kart, you must wait 5 seconds before the go-kart responds.
- The controls don't seem to work quite right—you can only control your go-kart occasionally.
- It is hard to predict exactly how the go-kart will move when you do operate the controls.
- You do not choose the game soundtrack, your character, or the kart—nearly everything is picked by the game for you.
- The game never tells you the status of anything, including where you're at, the progress that you have made, how much time has passed, or how many points you have.
- There are no other characters in the game or human players you can play with or communicate with; you are completely isolated.
- You don't know how fast you're going or your rank at any time during the race.

### *Scenario 2.4 (#8)*

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You expect the game to be a lot of fun and to involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:


**Figure C-8. Scenario 2.4 (#8)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- This is a go-kart racing game.
- The purpose of this game is to experience various fun-filled adventures while you race around different tracks in a variety of interesting settings.
- The game has amazing, vibrant, and colorful graphics that are fascinating just to look at.
- There is a very interesting storyline throughout the game that involves more than racing; it changes and gets more interesting over time.
- The sound effects are very professional and appropriate to the storyline.
- The music in the game is made up of some of your favorite songs.
- The game is carefully designed to be like a movie. Playing the game is like going to a place where a person can escape the real world and enter a care-free fantasy world.
- The game conveys a very high sense of realism: your go-kart makes realistic noises; you easily get a sense of speed, braking, and steering; and the scenery changes as you drive by.
- The level of challenge of the game is just right—not too hard and not too easy.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- The entire game is very responsive.
- You feel like you're in complete control of your go-kart.
- Your go-kart responds instantly and effortlessly to your controls.
- If you want to, you can play with any number of other players over the Internet.
- You can easily communicate with other human drivers by speaking over a headset, and you can clearly hear them respond.
- The game gives you lots of choices about what car you pick, which character you choose, etc.
- The go-kart in the game responds realistically, as if you're driving a real go-kart.
- You can choose to socially interact with other human players to discuss the game if you want to.
- You can also choose to listen to any song in the game soundtrack which includes hundreds of songs.
- The game continually gives you the status of everything: where you're at, how many points you have, how much time has passed, etc.
- There are dozens of computerized animals and creatures in the game that playfully race against you.

### *Scenario 3.1 (#9)*

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You expect the game to be a lot of fun and to involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:

**Figure C-9. Scenario 3.1 (#9)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- This is an "adventure" game in which you are supposed to travel around the globe, but every location you see in the game is a vast, empty desert.
- The music in the game is performed very poorly by what could be a junior-high school band.
- As far as you can tell, the only landscape you can walk through is a desert that has little variation.
- You cannot find any interesting objects to examine.
- The graphics are very plain and unappealing; they appear to have been created by a computer programmer rather than an artist.
- You wander the desert for an hour and there is virtually no change in the storyline or graphics.
- You walk on and on and on and on through the desert. It seems endless.
- The level of challenge of the game is completely below your abilities.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- You only control your character occasionally—most of the time the computer guides him for you so that playing the game is like watching a movie.
- The game isn't very responsive—it is an online game that you play over a slow dial-up internet connection.
- There are only a couple of trivial choices you can make about the game play; no other choices are given.
- Response time is so slow that when you press a direction on your controller to move your character, you must wait 5 seconds before your character moves.
- You only get to make a few choices in the game, and the choices don't seem to affect the story much or affect the game in the way you expect.
- Often it will take a long time before your choice has any impact on the story.
- There are other characters in the game, but when they speak they just stick to a script. It really doesn't matter what you're doing—it doesn't affect what they tell you.
- You do not choose the game soundtrack, your character, or how you walk—nearly everything is picked by the game for you.

- The game never tells you the status of anything, including where you're at, the progress that you have made, how much time has passed, or how many points you have.
- There are no human players you can play with or communicate with.

### Scenario 3.2 (#10)

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You expect the game to be a lot of fun and to involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:


**Figure C-10. Scenario 3.2 (#10)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- This is an “adventure” game in which you are supposed to travel around the globe, but every location you see in the game is a vast, empty desert.
- The music in the game is performed very poorly by what could be a junior-high school band.
- As far as you can tell, the only landscape you can walk through is a desert that has little variation.
- You cannot find any interesting objects to examine.
- The graphics are very plain and unappealing; they appear to have been created by a computer programmer rather than an artist.
- You wander the desert for an hour and there is virtually no change in the storyline or graphics.
- You walk on and on and on and on through the desert. It seems endless.
- The level of challenge of the game is completely below your abilities.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- You can effortlessly guide your character around the land because he instantly responds to your controls.
- You have lots of freedom to explore the land in any direction you choose.
- There are dozens of other characters in the land whom you can easily speak to and who respond intelligently to what you say.
- There are hundreds of tasks in the game, and you get to choose which tasks to do first.
- You can also choose to listen to any song in the game soundtrack which includes hundreds of tunes.
- The game gives you lots of choices as you explore.
- The entire game is very responsive, and seems to instantly obey your input and commands.
- If you want to, you can play with any number of other players over the Internet.
- You can easily communicate with other players by speaking over a headset, and you can clearly hear them respond.
- The system is so responsive it feels as though you are communicating with an actual person.
- You feel a sense of real connection, almost as if the experience is real.
- The storyline changes throughout the game according to what you are currently doing and what you have done in the past.
- The game continually gives you the status of everything—where you’re at, how many points you have, how much time has passed, etc.

### *Scenario 3.3 (#11)*

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You expect the game to be a lot of fun and to involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:

**Figure C-11. Scenario 3.3 (#11)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- This is an "adventure" game in which you travel around the globe to exciting places and have various fun experiences.
- The storyline is extremely engaging and well written—you find yourself really caring about the characters in the game.
- Every location in the game is unique and wonderfully detailed so you are always interested to see what comes next.
- The characters you talk to are often hilarious and you laugh frequently as you play.
- The game has amazing, vibrant, and colorful graphics that are fascinating just to look at.
- The sound effects are very professional and appropriate to the storyline.
- The music in the game is made up of some of your favorite songs.
- The game is carefully designed to be like a movie. Playing the game is like going to a place where a person can escape the real world and enter a care-free fantasy world.
- The game soundtrack is made up of your favorite music and helps you really get into the game.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- You only control your character occasionally—most of the time the computer guides him for you so that playing the game is like watching a movie.
- The game isn't very responsive—it is an online game that you play over a slow dial-up internet connection.
- There are only a couple of trivial choices you can make about the game play; no other choices are given.
- Response time is so slow that when you press a direction on your controller to move your character, you must wait 5 seconds before your character moves.
- You only get to make a few choices in the game, and the choices don't seem to affect the story much or affect the game in the way you expect.
- Often it will take a long time before your choice has any impact on the story.

- There are other characters in the game, but when they speak they just stick to a script. It really doesn't matter what you're doing—it doesn't affect what they tell you.
- You do not choose the game soundtrack, your character, or how you walk—nearly everything is picked by the game for you.
- The game never tells you the status of anything, including where you're at, the progress that you have made, how much time has passed, or how many points you have.
- There are no human players you can play with or communicate with.

### *Scenario 3.4 (#12)*

**Scenario background:** You've had a long, hard, and stressful day. You're happy to finally be home and you are ready to relax. All day you've been looking forward to trying out a new video game you recently bought. You're hoping this video game will help take your mind off of things. You expect the game to be a lot of fun and to involve a lot of intriguing interaction. The following describes the game that you experience as you sit down and play it:

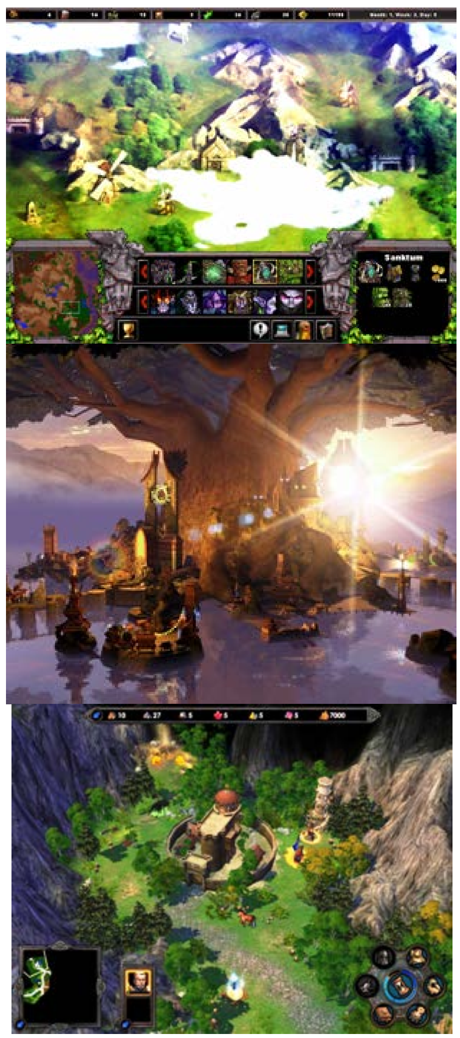

**Figure C-12. Scenario 3.4 (#12)**

Note: The following statements are to help you form a strong impression of how entertaining / fun you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- This is an “adventure” game in which you travel around the globe to exciting places and have various fun experiences.
- The storyline is extremely engaging and well written and takes you to another world of fantasy.
- There are other characters in the game that have interesting, vivid personalities who seem life like.
- Every location in the game is unique and wonderfully detailed so you are always interested to see what comes next.
- The characters you talk to are often very funny and you laugh frequently as you play.
- The game has amazing, vibrant, and colorful graphics that are fascinating just to look at.
- The sound effects are very professional and appropriate to the storyline.
- The music in the game is made up of some of your favorite songs.
- The game is carefully designed to be like a movie. Playing the game is like going to a place where a person can escape the real world and enter a care-free fantasy world.

Note: The following statements are to help you form a strong impression of how interactive / responsive you believe the scenario would be in real life. Remember to actively imagine what it would be like for you to do this for at least two hours.

- You can effortlessly guide your character around the land because he instantly responds to your controls.
- You have lots of freedom to explore the land in any direction you choose.
- There are dozens of other characters in the land whom you can easily speak to and who respond intelligently to what you say.
- There are hundreds of tasks in the game, and you get to choose which tasks to do first.
- You can also choose to listen to any song in the game soundtrack which includes hundreds of tunes.
- The game gives you lots of choices as you explore.
- The entire game is very responsive, and seems to instantly obey your input and commands.
- If you want to, you can play with any number of other players over the Internet.
- You can easily communicate with other players by speaking over a headset, and you can clearly hear them respond.
- The system is so responsive it feels as though you are communicating with an actual person.
- You feel a sense of real connection, almost as if the experience is real.
- The storyline changes throughout the game according to what you are currently doing and what you have done in the past.
- The game continually gives you the status of everything—where you’re at, how many points you have, how much time has passed, etc.

## Descriptions of the Four Games for Study 2

Table A2.7 further summarizes the four games and why they were chosen. This table is followed by screen shots of all four games.

**Table C-1. Further Detail on Study 2 Games**

| Game # | Game Name | Expected joy | Expected PEOU | Description of why low-high |
|---|---|---|---|---|
| 1 | Hitchhiker's Guide | Low | Low | This is a DOS-based non-graphical classic, text-based adventure game, which should be low on interaction and low on joy, especially to those who are used to more entertaining games. |
| 2 | Bubble shooter | High | Low | This is a graphical game that is generally said to be quite addictive once you get used to it, according to online players; however, the interaction and interface style is unusual and takes a while to pick up. |
| 3 | Shooting Fish | Low | High | This is a graphical game that many people find annoying/boring, according to online players. It's easy to use but it just doesn't deliver on "fun." |
| 4 | Black Knight | High | High | This is a highly usable, interactive game that is said to be quite addictive and easy to use |

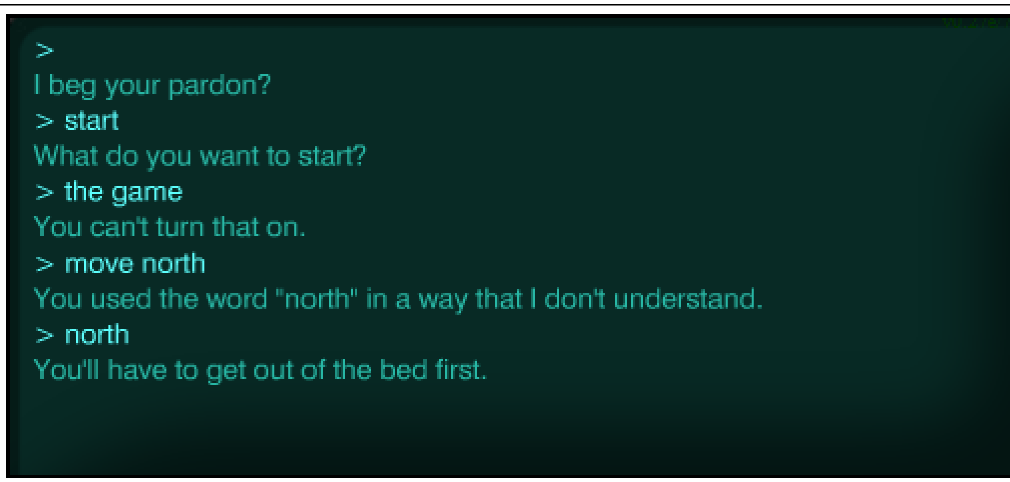


**Figure C-13. Screen Shot from Game #1: Hitchhiker's Guide**


**Figure C-14. Screen Shot from Game #2: Bubble Shooter**

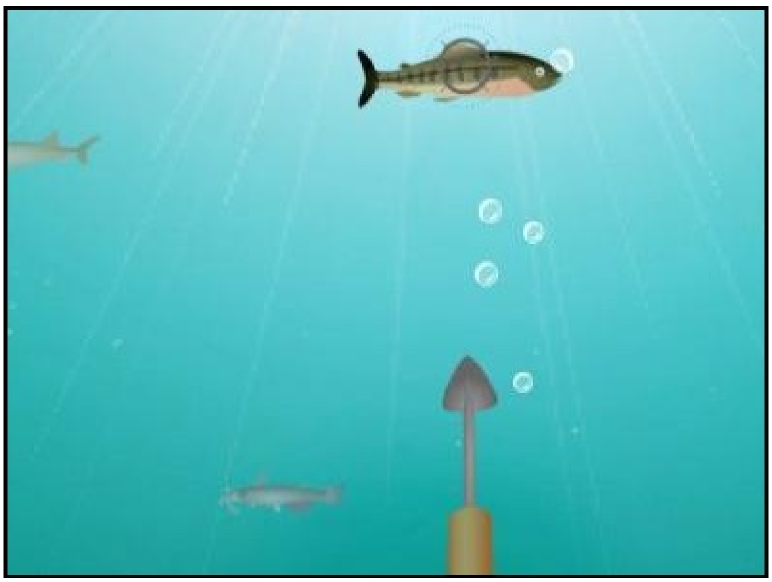

**Figure C-15. Screen Shot from Game #3: Shooting Fish**


**Figure C-16. Screen Shot from Game #4: Black Knight**

## About the Authors

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